NATIONAL MUSEUM OF VICTORIA

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VICTORIA · · · AUSTRALIA

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Issued by direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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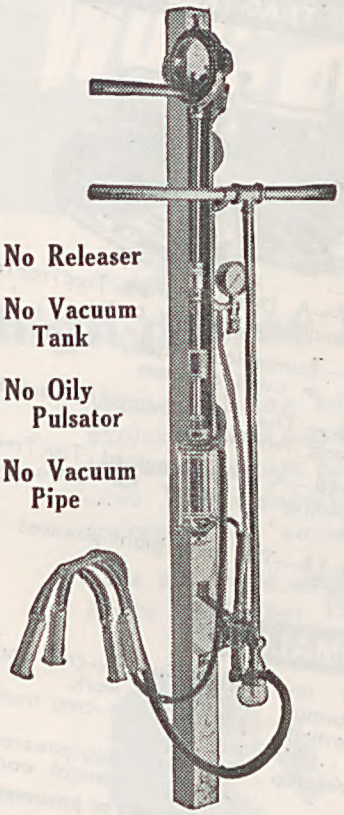

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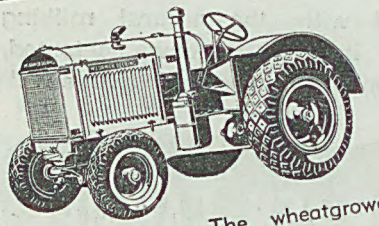

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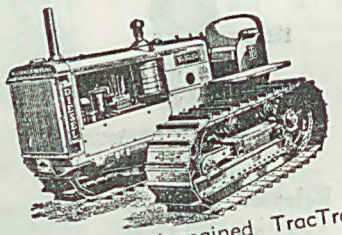

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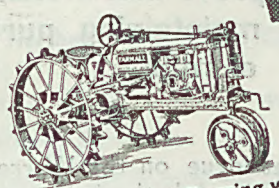

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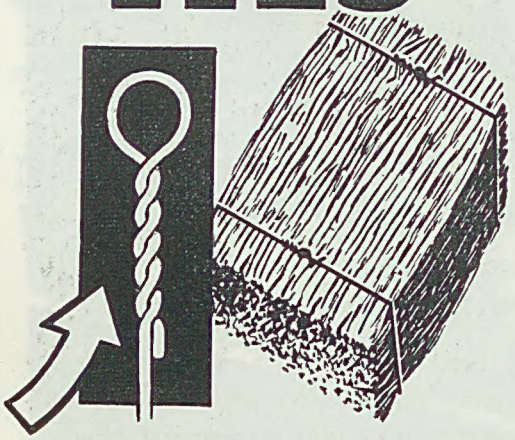

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School of Dairy Technology

Official Opening

THE School of Dairy Technology, erected on the State Research Farm at Werribee, was opened on Friday, 23rd June, by the Minister for Agriculture (the Honorable E. J. Hogan, M.L.A.), in the presence of some 500 people, including representatives of all sections of the dairying industry—producers, manufacturers, commerce, and allied interests.

After extending a welcome to the visitors Mr. Hogan said that for many years the dairying industry had requested the Government to establish an institution to train operatives for the butter and cheese factories of the State. In 1926 the Government had agreed to establish a dairy college, but representatives of the dairying industry were unable to agree to a site, and no action was taken.

In 1935 representatives of the dairying industry agreed to Werribee as the site and since then this dairy college had been erected at a cost of £14,200 of which £1,400 was provided by the Commonwealth Government, and £1000 by the Australian Dairy Produce Board.

The importance of the dairying industry, Mr. Hogan continued, justified the establishment of the college. The industry needed improved technical assistance to eliminate faults in the manufacture of butter and cheese. Factories had been handicapped by the lack of adequately trained men, and consequently the butter exported from Victoria occupied a position second to New South Wales so far as quality was concerned.

The college would attend first to the most pressing requirement of the industry—the higher training of dairy factory operatives. Suitable young men employed in butter and cheese factories, would be given a course of training in two periods of four months each. These periods would be in the slack time of butter and cheese production. Successful students would receive a Certificate of Competency.

Problems arising out of dairy manufacture in Victoria and the elimination of faults in the manufacture of butter and cheese would be investigated at the college throughout the year.

Emphasizing the importance of the dairying industry in Victoria, Mr. Hogan pointed out that the land used for dairying, cows, farm plant, factories and equipment in this State represented a capital investment of £80,000,000. The industry gives employment to thousands of people; 35,373 dairy farmers are engaged in it, and it creates £13,000,000 of new wealth in this State each year. The 140 Victorian butter factories and 36 cheese factories last year produced 141,321,000 lb. of butter and 16,466,000 lb. of cheese.

Exports totalled 77,695,000 lb. of butter valued at £3,577,000 and 10,371,000 lb. of cheese valued at £350,634.

"This great Australian industry," Mr. Hogan added, "is threatened by margarine, which is made largely from imported copra, and imported oils and fats. Margarine is made to closely resemble butter in appearance, and in some cafes, restaurants and hotels it is being foisted on to the

The Minister for Agriculture, The Hon. E. J. Hogan, M.L.A., officially opens the School of Dairy Technology. *Leader* Photo.

consumers as butter. Beef fat to make margarine is bought from farmers and graziers and butchers for 1¼d. per lb., and imported copra for about 1d. per lb., and margarine made from either material is sold retail at a huge profit for 1s. 2d. per lb.

"Butter-fat to make butter is bought by butter factories from dairy farmers for 1s. 3½d. per lb., and butter made from butter-fat is sold retail for 1s. 6d. to 1s. 8½d. per lb."

In 1937–38, the Minister continued, 6,250,000 lb. of margarine was made in Victoria and was sold for £193,572. The production of margarine in Victoria during 1938–39 was estimated to be over 7,000,000 lb. The dairying industry objected to the manufacture and sale of margarine made from imported black labour products and the "confidence trick" that was being worked on Australian consumers by disguising table margarine to look like butter.

The Victorian Government had passed legislation to prevent this deception, but that legislation had not been effective because the margarine manufacturers in New South Wales had taken advantage of section 92 of the Commonwealth Constitution; and were able to make margarine in New South Wales and sell it here uncoloured.

There were considerable difficulties in achieving uniform margarine legislation in all the States. Victoria had taken effective steps to control the sale of margarine, but other States would not take similar action.

The dairying industry must make representations to ensure that legislation was enacted and enforced in all States to prevent margarine masquerading as butter and displacing large quantities of butter from Australian tables.

The Australian butter thus displaced by margarine had to be exported and sold overseas at a heavy financial loss to the dairying industry.

"If the policy of protection and white Australia is not a myth," Mr. Hogan concluded, "this unfair competition must be remedied by all the Governments, and they should be asked by the dairying industry to declare whether they stand for margarine interests or for the Australian dairying industry."

Inspecting a pasteurizer.
Leader Photo

Mr. H. A. Mullett, Director of Agriculture, said the school fulfilled the long-cherished desire of officers of the Department of Agriculture that they should be in a position to give every possible assistance to the dairying industry. Although delay had been experienced in the establishment of the school, it had proved advantageous, as it enabled the department to give to Victoria an institution which was unequalled in Australia.

The school had been modelled on the Massey Research Institute of New Zealand, and, apart from the facilities for chemical and bio-chemical research incorporated in the school buildings, a model butter and cheese factory had been provided to enable the students to study all branches of production. In connexion with the laboratories, the Council for Scientific and Industrial Research had entered into an arrangement with the Department of Agriculture for co-operative work, and as a result the school would become the dairy research centre of Australia.

Sir David Rivett, Chief Executive Officer of the Council for Scientific and Industrial Research said the Council was pleased to be associated with such a fine institution, and would be prepared to co-operate in its research work in every way possible. Much could be done by the application of the best team spirit, and he was pleased to be able to announce that Dr. Wiley (formerly of New Zealand) was coming to take part in the research work at the school. This spirit of co-operation could be taken as an example of what should always exist in public life.

Supporting a vote of thanks moved by Mr. Bennett, M.L.A., the President of the Victorian Dairymen's Association, Mr. Angus McKenzie, congratulated the Minister on the completion of the Institute and said he trusted that in the years to come the certificate of the College would become the hallmark of efficiency throughout Australia.

Mr. McKenzie said that the Minister for Agriculture had been the champion of orderly marketing in Australia. He was responsible for the introduction of legislation for orderly marketing which he had solidly supported ever since.

Visitors in the chemical laboratory. *Leader* Photo.

Buildings and Equipment.

The School of Dairy Technology is a brick building of modern design and attractive appearance, and includes a modern dairy factory, chemistry and bacteriology laboratories, and administrative rooms.

On the ground floor of the school section are the offices; a spacious lecture room; staff room and library; students' common room and lavatories—above these are the two laboratories with smaller preparation rooms at the rear. The laboratories are of modern construction, and are particularly well supplied with the latest electrically controlled equipment, microscopes, balances, and other instruments of precision. Gas is manufactured by a very efficient petrol air gas generating plant.

The experimental dairy factory consists of butter and cheese manufacturing sections with attendant cold chambers, boiler room, test room and office, with the latest type of equipment installed in a compact and efficient lay out.

Special features include the absence of overhead shafting, pulleys and belting; each unit being directly driven by an electric motor of adequate power, making for sanitation, safety and appearance. The metal equipment is largely of stainless steel finished to a mirror polish of sound all welded construction, giving an installation capable of thorough cleaning and sterilization. The boiler is oil fired, the fuel tank being underground and of 1,000 gallon capacity. Vital services, steam, water, and brine lines are coloured red, blue, and white, enabling rapid and correct differentiation of each to be made right throughout the factory. This is essential for both instruction and additions. Adequate lighting, ventilation, and drainage, with the up-to-date and complete equipment make the factory a model in miniature. For experimental and instructional purposes, the equipment is smaller in size than is found in a commercial factory.

The purpose of the School of Dairy Technology is twofold. Both instruction to factory operatives and research into manufacturing problems will be undertaken. The factory operatives must have extensive practical experience before being admitted to the course, which lasts for two terms each of four months in the autumn and winter of successive years. Subjects in which instructions are given include chemistry, bacteriology, bookkeeping, dairying, and engineering, and very thorough practical experience in all phases of butter or cheese manufacture (depending upon the particular section being taken up by the student).

Education in factory practice is carried further by the system adopted, which, by rotation of duties and successive assumption of authority by each student in turn, under the supervision of the Factory Superintendent, gives training in handling men as well as equipment.

Research work into problems affecting the manufacture of dairy produce will be continued by the staff while the students are back at their respective factories.

Margarine Legislation

The *Argus* on June 13th published an advertisement criticizing the Victorian legislation which requires margarine sold for table use to be coloured saffron so that consumers would know it was margarine and not butter. This advertisement appeared under the name of John Allsopp, who claimed to be "a Teacher of Dietetics in the New South Wales Education Department."

The Minister of Agriculture, Mr. Hogan, stated last week that he had written to the Hon. D. H. Drummond, Minister of Education for New South Wales inquiring whether Mr. Allsopp was an officer of that Department.

Mr. Hogan has received the following reply from Mr. Drummond:—

> "In reply, I would point out that this Department has no specified male teachers of dietetics. The name John Allsopp does not appear amongst the teaching staff of the Department. We have a Francis Joseph Allsopp and an Arthur Henry Allsopp, but neither could be described in any way as a teacher of dietetics.
>
> Inquiries have failed to reveal any trace of the individual described in your communication.
>
> Yours faithfully,
> (Signed) D. H. Drummond,
> Minister of Education."

Fodder Conservation

Wangaratta Competition

Report of Judge, Walter D. Andrew, M.Agr.Sc., Assistant Agrostologist

THE conservation of fodder for periods of scarcity has always been a necessary part of the farm routine, but with the increase in carrying capacity brought about by the improvement of pasturage, the need for reserves of fodder is now greater than ever.

In the Wangaratta district where farmers have effected great improvements in their pastures by the application of superphosphate and the replacement of the native grassland species by the better-introduced ones, there is ample evidence of the growing appreciation of fodder conservation, and it was pleasing to note that, of the six competitors, five had reserves well in excess of the requirements for 12 months.

A deteriorated, grassy pasture.

Under normal circumstances farmers have an abundance of herbage in the spring, and the disposal of this is as important to the welfare of the pasture as its conservation is to the nutrition of the stock during the leaner periods of the year.

Pastures which are allowed to become tall and rank year after year deteriorate in quality and productiveness, for this type of management has a depressing effect on the development of the essential clover species while in addition the sward becomes open and the establishment of weeds which have been allowed to seed freely is facilitated.

Under the conditions which prevail in the north-eastern districts of Victoria, the making of meadow hay is usually a safe and convenient practice, and a large amount of the herbage conserved is in this form. The making of good meadow hay requires great judgment, and no less skill than the proper carrying out of many of the other operations on the farm. While, in some cases, the meadow hay conserved is of excellent quality, in others there appears to be the tendency to sacrifice quality for quantity, the practice being to cut late in order to gain the maximum yield of dry matter per acre.

With the majority of pasture plants there is a rapid increase in fibre content and a diminution in nutritive value after the flowering stage is reached, and, although a late cut may achieve a slightly heavier yield of air dried herbage, the actual amount of fodder nutrient harvested may be less.

In the making of hay, careful attention to detail is essential, for it has been estimated from experiment in the field that a loss in nutrients of up to 25 per cent. can occur from the time of cutting until the material is consumed; of this loss 10 per cent. can occur before the material even reaches the stack.

To reduce this latter loss rapid curing, but not over curing, and a minimum of handling are essential, and for this purpose the use of the sweep, side delivery hay rake, grab stacker, and hay press are particularly useful.

A sweep attached to the front of a tractor.

Where large quantities of hay are to be cured under good drying conditions (unless there are means for its rapid disposal), it is a wise practice to cock the hay to prevent it becoming too dry and brittle in which condition a large amount of valuable leafage is lost during handling.

It is generally recognized by the farmer that losses do occur after the material has been collected from the field but because meadow hay is not subject to such apparent damage as is cereal hay there is less attention paid to its protection than there should be.

One must recognize the fact that each unit of nutrition collected from the field is a valuable commodity and represents so much labour expended. If adequate protection is not provided not only are valuable food units lost but also many of the hours of hard labour which were expended in their collection.

With material stacked in the open, the roof and floor of the stack are places to which adequate protection can and should be given. A sectional roof of galvanized iron offers great possibilities as an efficient means of protecting the top, while suitable protection at the bottom entails the use of a raised floor either of wood or earth. If earthern, the floor should be given a surface coating of some bituminous material to render it impervious to moisture.

It should be noted that the conditions which favour the growth of mould on hay are also favorable to the development of the *Bacillus botulinus,* the bacillus which produces the poisonous toxin causing Botulism or food poisoning. The practice of baling hay by which means a large reduction in the volume of the material is effected, not only facilitates its

A typical unprotected stack.

Baling a short crop of oaten and grass hay.

A useful type of hay shed.

storage inside sheds but at the same time transforms it into units of convenient size for subsequent handling, and it was significant that 60 per cent. of the hay submitted by the competitors was in the baled form. Of the several types of press available, those which fold the material during pressing are popular because of the ease with which the material can be drawn apart when the bale is subsequently opened for use.

Meadow hay can be baled with safety provided its moisture content is not in excess of 30 per cent., in which condition it is definitely too damp for stacking in the ordinary manner, but it is important that the material be well mixed as wet patches in the bale invariably cause mould and brown patches in the hay.

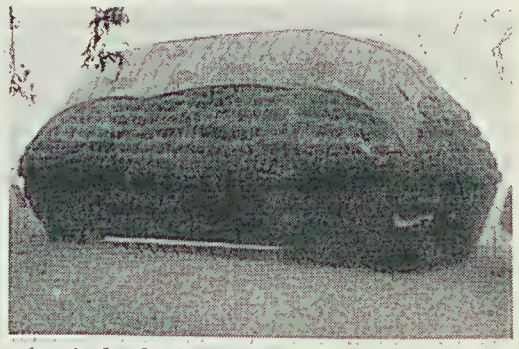
Under ordinary circumstances pressing in the field is fairly safe practice, but in places where large quantities are to be handled and there may be any delay in the pressing, it is probably wiser to stack the material first to avoid the possibility of losses by rain or overdrying. While the practice of conserving herbage in the form of hay is a commendable one, it is inadvisable to hold the entire surplus in this form, as hay lacks succulence and is therefore not a complete fodder for stock during the dry summer months.

An admirable type of fodder reserve for this period is silage which, in addition to succulence, also possesses a large amount of the carotene originally present in the green herbage, whereas in hay this is mostly destroyed during curing.

Carotene, which is associated with the green colouring matter in herbage, is a source of "Vitamin A" for the stock, and it is the material largely responsible for the desirable yellow colour in milk, cream, and butter. Silage is therefore very valuable to the dairy farmer during the drier period of the year.

The ensiling of herbage is essentially a means of preservation, and it is incorrect to suppose that by this means innutritious herbage can be made into fodder of a high nutritive value; in addition the popular belief that silage-making is entirely independent of weather conditions is an erroneous one.

Admittedly it is possible to make herbage into good silage under conditions which would be unsuited to hay-making, but under very wet conditions it is practically impossible to transform succulent material into silage without a heavy loss of plant nutrient.



A nicely built stack.—Note absence of protection at the base.

Experiments have shown that herbage is best ensiled when its moisture content is about 70 per cent., and that efficient silage-making depends on the building up of lactic acid acidity and the control of the temperature of the ensiled mass within certain limits.

If a relatively large amount of air is entrapped during ensiling as a result of insufficient consolidation, a hot fermentation and a sweet dark-brown silage will be produced from most types of herbage. This sweet silage has the advantage of palatability, but the high temperature reached in its production usually denotes a large loss of carbohydrate material, and in cases where the temperature exceeds 120° F., a large amount of the protein material is often also rendered indigestible.

On the other hand, the exclusion of most of the air produces a colder fermentation and a more acid and less palatable silage, and in extreme cases where the material ensiled is immature, very luscious or rain sodden, the silage produced is often sour and unpalatable, and the losses which are mainly due to drainage of liquor are high.

Several acids are produced during ensilage, the most desirable one being lactic acid, which, on reaching a certain concentration, prevents the formation of other less desirable compounds. If, therefore, material is high in protein and relatively low in carbohydrate, it is a wise plan to add molasses, which readily ferments, to produce lactic acid.

Stack ensilage usually produces a hot fermentation, and heavy weighting is necessary to prevent an undue rise in temperature. Despite this precaution, the method is a relatively wasteful one, as it is very difficult to get adequate consolidation at the sides and prevent the wastage at the edges which, in some cases, involves the spoilage of at least a foot of material all around the stack.

Herbage ensiled in pit or tower silos usually undergoes a colder fermentation, which generally produces the green fruity or light-brown acid types of silage. and although these are not quite as palatable as the sweet brown silage, the process is less wasteful than with stack ensilage.

The erection of a tower silo is hardly justifiable in the majority of cases, and of the underground types, the trench is probably the most convenient and economical. In the selection of a site for an underground silo it is important to chose a well-drained position and avoid very porous or loose, crumbly soils.

A typical stack of grass silage.

At the present time, farmers in many districts are faced with an abnormal growth of very succulent herbage, and the problem of its disposal is uppermost in many minds.

Measurements carried out recently on experimental pasture plots at Benalla and Wangaratta have shown that the amount of herbage awaiting removal is somewhere in the region of 6 tons of greenstuff per acre, and its moisture content is approximately 85 per cent.

The ensiling of this material under present conditions will entail relatively large losses of nutrient, and in order to reduce these to a minimum, it is suggested that dry material such as hay or straw be incorporated with the green herbage and the ensiling be carried out slowly to allow each layer to heat up before the next is added.

During the recent drought there was a heavy mortality of perennial rye grass in many places, and the pastures at the present time are composed largely of clover and cape weed. It would seem that now is an opportune time to plough under some of this heavy growth; sow oats for grazing or harvesting in the spring, and in the autumn of 1940 the perennial rye grass can be re-sown on the oat stubble.

As an adjunct to pasture, the establishment of small paddocks of lucerne under normal seasonal conditions will provide a bulk of nutritious material for conservation. During the judging of the competition, several excellent lucerne stands were seen, and it was apparent that farmers in the Wangaratta district are well awake to its potentialities. As lucerne is a protein-rich plant, it is probably

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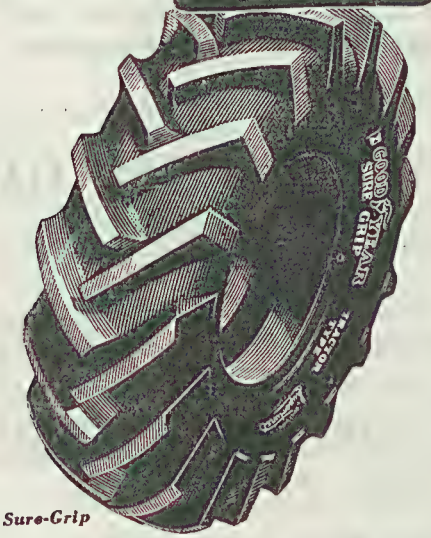

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wisest to conserve it in the form of hay owing to the inevitable losses that occur when ensiling material of this nature.

Cereal hay is always a useful material for feeding as a supplement to protein-rich material, and as it can in most places be produced for less than £2 per ton, it is quite an economical form of fodder reserve. Of all forms of conserved fodder, cereal hay requires most protection for, apart from weather deterioration, great damage can be caused by mice. In order to prevent this damage, it is necessary to encircle the stack with a low fence of galvanized iron, or alternatively, place tin baffles on the uprights supporting the platform on which the stack is built.

The Awards.

The winner of the 1938-39 competition was Mr. W. J. O'Brien of Hansonville, who had on hand 240 tons of pit silage, 42 tons of meadow hay, 29 tons of oaten hay, 26 tons of lucerne hay, 12 tons of oaten chaff, and 11 tons of lucerne chaff as a fodder reserve for 100 head of stock, on an area of 164 acres.

Mr. O'Brien gained 193 points out of a maximum of 200, and it would be difficult to find any farmer more adequately protected against a scarcity of pasture growth. Points were lost for protection, economy of production, and quality. With a little more attention to these details, this competitor would have attained the maximum of 200.

Second place with 176 points was gained by Mr. P. J. Tanner of Greta South, who had the bulk of his 66 tons of meadow hay pressed and under the cover of an iron roof, a large quantity of wheaten and oaten grain in specially adapted galvanized iron tanks, together with some 25 tons of pasture silage and 36 tons of good quality oaten hay. Mr. H. Walker, who gained third place by securing 174 points, had a large quantity of fodder on hand, but, unfortunately, lost points for the protection of his oaten hay and the quality of the baled meadow hay.

The points allotted to the various competitors are shown in the following table:—

Wangaratta Fodder Conservation Competition, Judged 2nd and 3rd May.

	Suitability and Quality of Fodder.—		Location and Protection.		Economy of Production, Etc.	Carrying Capacity.	Quantity in Excess of Requirements.	Total.
	Suitability.	Quality.	Locality.	Protection.				
Maximum points ..	**30**	**35**	**10**	**20**	**20**	**50**	**35**	**200**
W. J. O'Brien, Hansonville	30	33	10	17	18	50	35	193
P. J. Tanner, Greta South	29	34	10	19	19	50	15	176
H. Walker, Barwidgee ..	30	32	10	17	18	50	17	174
Dr. J. L. and Mrs. E. Henderson, Oxley ..	30	30	10	18	18	50	12	168
H. Wallace, Hansonville	30	30	10	15	18	50	11	164
W. J. Tetley, Oxley ..	28	25	10	19	20	25	..	127

London Markets

Weekly Prices

The following information as to prices offering in London for the principal Victorian primary products has been taken from cablegrams received each week by the Department of Agriculture from the Victorian Agent-General in London.

Product.	Price for Week Ending—				
	2nd June	9th June	16th June	23rd June	30th June
	d.	*d.*	*d.*	*d.*	*d.*
Lamb, 1st quality, Victorian .. .. 29–36 lb. ..	6¼	6⅜	6⅜	6½	6½
Lamb, 1st quality, Victorian .. .. 37–42 lb. ..	5¾	5¾	6	6⅛	6⅛
Lamb, 1st quality, other States .. 29–36 lb. ..	6⅛	6⅛	6⅛	6⅛	6⅛
Lamb, 1st quality, other States .. 37–42 lb. ..	5¾	5¾	5¾	5¾	5¾
Lamb, 2nd quality, Victorian .. .. 28 lb. and under	6⅝	6¾	6¾	6¾	6¾
Lamb, 2nd quality, Victorian .. .. 29–36 lb. ..	5⅞	6	6⅛	6⅛	6¼
Lamb, 2nd quality, other States .. 28 lb. and under	6½	6⅝	6⅝	6⅜	6⅜
Lamb, 2nd quality, other States .. 29–36 lb. ..	5⅝	5¾	5⅞	5⅞	5⅞
Lamb, 3rd quality, all States .. .. 28 lb. and under	6⅜	6½	6½	6⅜	6⅜
Lamb, 3rd quality, all States .. .. 29 lb. and over	5⅛	5⅜	5½	5½	5½
Mutton wethers and/or maiden ewes .. Under 40 lb.	3⅝	3⅞	3⅞	4	4⅛
Mutton wethers and/or maiden ewes .. 41–48 lb. ..	3½	3⅝	3⅝	3⅝	3¾
Mutton wethers and/or maiden ewes .. 49–56 lb. ..	..	..	..	..	..
Mutton ewes .. .. Under 40 lb.	3½	3¾	3¾	3⅞	4
Mutton ewes .. .. 41–48 lb. ..	3¼	3⅜	3⅜	3½	3½
Beef, frozen ox hinds .. .. 145–210 lb. ..	3⅞	3⅞	3⅞	3⅞	3⅞
Beef, frozen ox crops, weights corresponding	3⅛	3⅛	3⅛	3⅛	3¼
Beef, chilled ox hinds .. .. 145–210 lb. ..	4⅞	4	4	4⅝	4⅝
Beef, chilled ox crops, weights corresponding	3⅛	2⅝	2½	2¾	3⅛
Pork, Australian 1st quality .. .. 60–80 lb. ..	6¾	6¾	6¾	6¾	6⅞
Pork, Australian 1st quality .. .. 81–100 lb. ..	6⅝	6⅝	6⅝	6¾	6⅞
Pork, New Zealand 1st quality .. 60–80 lb. ..	6¾	6¾	6¾	6¾	6⅞
Pork, New Zealand 1st quality .. 81–100 lb. ..	6⅝	6⅝	6⅝	6¾	6⅞
	s.	*s.*	*s.*	*s.*	*s.*
Bacon, Canadian .. .. .. per cwt. ..	80	80	82	88	91
Bacon, Empire (cured in England) .. per cwt. ..	79	79	80	86	88
Bacon, Danish .. .. .. per cwt. ..	90	90	90	95	98
Butter, unsalted, choicest grade .. per cwt. ..	113–114	115–117	113–114	113–114	112–114
Butter, unsalted, 1st grade .. .. per cwt. ..	111–112	114	112	112–113	111–112
Butter, unsalted, 2nd grade .. .. per cwt. ..	..	..	..	..	..
Butter, unsalted, pastry grade .. .. per cwt. ..	..	..	..	..	..
Butter, salted, choicest grade .. .. per cwt. ..	112	115–116	111–112	113–114	113–114
Butter, salted, 1st grade .. .. per cwt. ..	110–111	114–115	109–110	112–113	112
Butter, salted, 2nd grade .. .. per cwt. ..	108	111–112	106–108	108–109	108–110
Butter, salted, pastry grade .. .. per cwt. ..	104–106	108	104–105	104–106	105–106
Butter, Danish .. .. .. per cwt. ..	118	125	120	122	123
Market (butter)	Quieter at the end of the week.	Quieter at the end of the week.	Closing Steadier.	Firm and active.	After quiet opening demand improved at the end of the week.

Glasshouses for Tomato Culture

By B. P. Krone, Fruit Packing Instructor.

Showing the arrangement of glasshouses for tomato culture in Victoria.

ALTHOUGH unheated glasshouses may be profitable in certain parts of Victoria, it is doubtful if the added expense of an artificially heated glasshouse would be warranted. When Victorian-grown tomatoes are not available, tomatoes can usually be purchased at a reasonable price from South Australia, Queensland, and Western Australia. Growers who intend to erect artificially-heated glasshouses should, therefore, consider the cost of this form of production very carefully.

Unheated glasshouses can be erected much more cheaply and are satisfactory. In Victoria, this type of production has become quite popular during the past few years and standardized methods of building the houses have been adopted. This has resulted in less costly and simplified methods of construction, for example, special galvanized iron rafters are used, which eliminate putty and are easily removable. These rafters have specially designed grooves into which the glass fits, while other grooves, ingeniously arranged, carry rain water from the roof. Such rafters have been patented, but are comparatively cheap, costing approximately 1s. 6d. per length of 8 feet.

In Victoria, the modern glasshouse is built to standard specifications, for example, 100 feet long by 15 feet wide, and if more than one is required, they are built side by side and spaced 15 feet apart in such a manner that, when renovation or a change of soil is necessary, the roofs and end walls are transferred to cover the intervening spaces which then become the glasshouses. The areas which were previously enclosed in the glasshouses then undergo their treatment of soil renovation, or may be used for other purposes. It is important to note that the framework for a standard glasshouse built with bottom plates and studs, as is the usual practice for wooden buildings, will not be satisfactory. Bottom plates and studs together with the weight of the glass will cause such a long structure to weave in the centre. It is important, therefore, that all uprights be set about 18 inches into the ground like posts.

Specification of a Standard Unheated Glasshouse.

Length 100 feet, width 15 feet, height of gable 6 ft. 6 in., height of eaves 3 ft. 6 in.

Material Required.

17 *posts* 3 x 3, 8 *feet long,* and spaced 6 ft. 3 in. (centre to centre) along the centre of the house; 6 ft. 6 in. out of the ground.

34 *posts* 3 x 2, 5 *feet long,* and placed 6 ft. 3 in. (centre to centre) for both of the side walls; 3 ft. 6 in. out of the ground.

24 *pieces of* 3 x 2, 12 *ft.* 6 *in. long* as top plates for the side walls and gable ridge. In other words, 300 running feet of 3 x 2.

230 *feet of* 6 x 1 *Red Gum or Jarrah* skirting board to go right around the outside of the building at the ground level.

690 *feet of* 2 x 1 *Oregon battens* groved $\frac{5}{8}$ inch on lower edge and $\frac{1}{4}$ inch on top to hold the glass on the side and end walls. The first row of these battens should rest directly on top of the skirting board and be nailed on around the building. Sometimes a skirting board can be procured already grooved to take the glass which, of course, would obviate the necessity for the first grooved batten. The second row of battens should be nailed on about half way up the wall, with the deeper groove facing downwards, and in such a manner that the lower panes of glass can be easily slipped in or out. A third row of battens is sometimes nailed on around the top of the wall to hold the top of the second row of glass, but a cheaper and popular method of fixing the top of the top row of glass is to dispense with the top row of battens and use a thin wire, stapling it between the panes of glass to the top plate instead.

18 *wooden rafters,* 3 x 2 *grooved Oregon,* 8 *feet long* are placed in pairs on top of the top plate, and directly over the top of each upright to form the gable.

160 *patent galvanized iron rafters,* 8 *feet long.* These cost about 1s. 6d. each. Ten pairs of these rafters usually follow each pair of wooden rafters.

25 *cases of* 16 x 14 *inches,* 18-*oz. glass*—(21-oz. is better but dearer). The approximate cost of glass in Melbourne would be 35s. per case.

The total cost of materials would vary between £65 and £75 according to the available supply of timber, &c.

Construction.

The first consideration is the site of the glass house, and after choosing the sunniest situation it is most important that the house runs north and south so that the whole of it may benefit not only from the early morning sun, but the sun in the late afternoon as well.

It makes a sturdy job if one pair of wooden rafters is placed after each tenth pair of galvanized iron rafters, centred about 15 inches apart to take the 14-inch glass. It is also important that the wooden rafters be strong (Oregon is recommended) and that they rest over the top of the uprights, because it is these rafters that support most of the weight of the tomato crop as it develops. When the framework is finished, leave a space about 18 or 20 inches wide at each end for a light door which can be constructed from lining boards or other handy material.

Commencing from the lower sides of the roof, the glass is slipped up the grooves in the rafters, allowed to overlap $\frac{1}{2}$ inch and held in place by small strips of galvanized iron cut about an inch wide and bent in the form of small flattened S-hooks. These hang from the top of each piece of glass in such a manner that the lower part of each hook prevents the succeeding sheet from slipping down. The bottom sheets of glass are supported by strips

Showing end view of a standard glasshouse.

The old style of glasshouse used in Victoria. This type is quite efficient but more costly to construct.

of galvanized iron or hoop iron which are nailed to the top plate of the side wall and bent up to prevent the glass from slipping down. Six rows of glass on each side complete the roof. In the gable ends of the walls it will be necessary to cut a few sheets of glass to conform with the shape of the gable.

Ventilation and Frost Control.

Ventilation is most important—glass on each side of the ridge and around the walls should be adjusted for the purpose as the occasion arises. An ideal temperature range would be above 60° F. and as close to 70° F. as possible. Under a warm sun, the temperature may easily reach 90° F., however, if the sides are well opened no damage will occur. A heavy frost might have damaging results on the plants growing near the walls, particularly the south wall, therefore, thick hessian or bags should be placed around the walls on frosty nights.

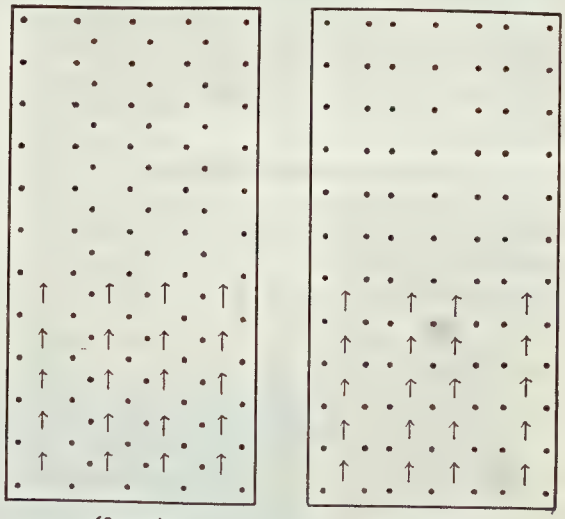
A cheap and more efficient method of frost prevention is to use several very small kerosene heaters. With this form of frost control, it should be borne in mind that several small heaters turned very low will give better results than one or two larger kinds, because it is only necessary to keep the temperature above freezing point for a few hours during the night.

Planting in Glasshouse.

Some growers adopt the 7-row method of planting tomatoes, spacing the plants approximately 1 foot apart, resulting in 700 plants per glasshouse. Others obtain satisfactory results with eight rows and 800 plants per house. The 7-row method requires little explanation, because the rows are usually spaced across the house, but, of course, in a manner that will provide access to each plant and adequate conditions for watering purposes, which can be done by means of a small furrow between each row.

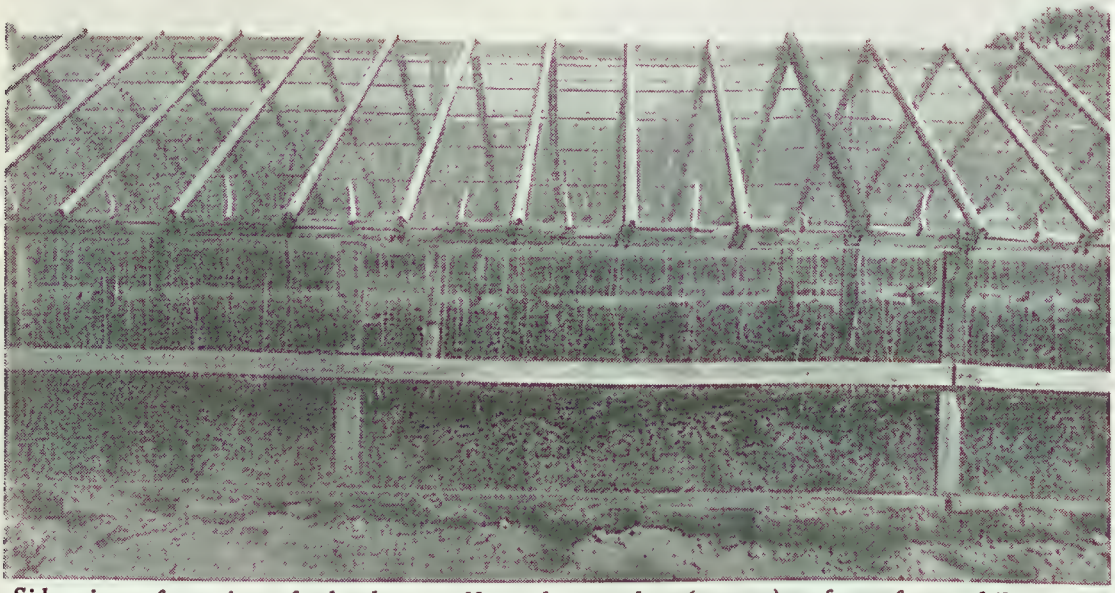
The layout of the 8-row method is slightly different. A single row of tomatoes is grown along each side wall, and three double rows are planted along the intervening space. This permits an extra 100 plants to be grown per glasshouse. The accompanying diagrams show both methods of planting.

In both instances, a row of tomatoes is planted as close to each side wall as is convenient, spacing the plants about 1 foot apart.



(8-row). *(7-row).*

Diagram of planting showing the arrangements of plants in a standard glasshouse. Left, the double or 8-row system; Right, single or 7-row system. The arrows indicate furrows for irrigation.



Side view of portion of glasshouse.—Note the wooden (oregon) rafters for stabilizing the structure. These rafters also support the weight of fruit as it develops. The manner of fixing the rafters is described. The strings on which the plants are trained can be seen through the glass.

In the 8-row method, the plants in the double rows are staggered, and planted approximately 1 foot apart each way; these double rows are spaced equally across the house.

In the single, or 7-row method, the plants are spaced, also, about 1 foot apart in the rows, but slightly wider spaces are provided on either side of the centre row and also between the first and second row from each side wall for cultural purposes. Personal convenience for working in the house is the deciding factor for this space.

Tying Up or Staking.

As the tomato plants in the glasshouse grow they are supported by lengths of hayband suspended from the roof. The method of fixing these haybands is as follows:— Small screw-eyes are screwed into the wooden rafters of the roof on the inside of the house and, through these screw-eyes, a length of ordinary fencing wire is threaded, then tightened, and firmly secured at each end of the house. These rows of overhead wires are placed directly above the top of each row of young plants with one hayband suspended from the wire for each plant. The lower end of each hayband is tied to another wire, which has been stretched tightly, about 6 inches above the ground along each row of plants, or, in some instances, in the absence of a lower wire, tied very loosely by means of a small loop around the base of the plant. As the plants grow, the haybands are simply given a twist around them.

Varieties Suited to Glasshouse Culture.

Some varieties of tomatoes appear to be more suited to glasshouse culture than others. Those which give satisfaction were included in a previous chapter entitled "Tomatoes of Outstanding Merit in Victoria and How to Grow Them," and were marked with an asterisk. (See June 1939 issue of this Journal.)

Although all these tomatoes may not suit one particular grower, they serve a useful purpose, some being of the dessert or cluster type, while others are of the Chinese type. The South Australian Dwarf is probably grown more extensively in standard glasshouses in Victoria than any other variety.

Frosting the Roof.

It is seldom necessary to frost the roof of a glasshouse for tomatoes as a protection from the sun; plenty of fresh air is the treatment on a hot day. However, in some instances, if it is necessary to frost the roof, the work should be done on the outside of the house, not the

(*Continued on page 338.*

A paspalum-clover pasture in the Cohuna district.

Fodder Competition

Results at Cohuna

Report of the Judge, A. Morgan, B.Agr.Sc., Irrigation Field Officer.

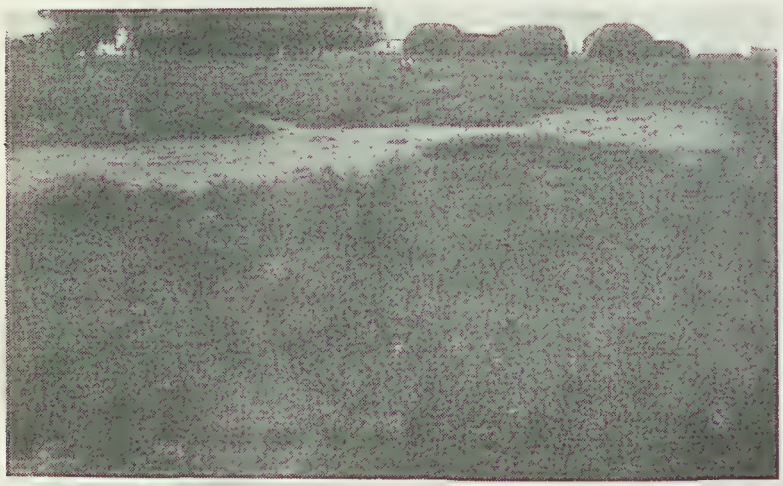
THE irrigation farmer, particulary if he lives in a district where the water supply is both abundant and readily available, has within his power a potentiality for intensive production which has been amply demonstrated during the judging of the competition conducted by the Cohuna Agricultural, Pastoral and Horticultural Society. Around the Cohuna district this has been fully recognized, and has been put into effect to such a degree that it is rapidly achieving a reputation as one of the "show" districts of the State.

Some years ago, when the alkali problem had undermined its prosperity, a vastly different picture presented itself, and the advances evident to-day are the more noteworthy on that account. To say that the problem of alkali has been completely solved would be an exaggeration, but certainly the progress made towards a full solution has been remarkable. One of the photographs accompanying this report attempts to convey some idea of the recovery made in the district by showing productive clover pasture, salt-affected land, and fodder reserves on one of the blocks visited.

A number of factors have contributed to the sum of success now evident. The institution of drainage having paved the way for their successful use, the proper application of research into methods of lay-out for irrigation, manuring, watering, and grazing management has been a factor of great benefit. Under these circumstances, where a fertile soil is allied to a plentiful supply of irrigation water and a full appreciation of the best ways in which to use it, where the possibilities of manuring with phosphate are recognized, and where some adherence to the principles of rotational grazing is usual, fodder conservation does not present a difficult problem in regard to obtaining the material to conserve. In fact, with the short winter season and the heavy pasture and lucerne growth which is possible, it is probable that on the best-developed blocks the fodder units regarded as essential under the terms of the competition are in excess of actual requirements. All the blocks are not fully developed, however, and are not in that happy position of being consistently possessed of surplus feed, and where the paddock growth at the end of April is poor the requirements of the competition are obviously necessary.

Portion of Mr. A. E. Fenn's dairy herd in a vigorous lucerne stand.

Before discussing the exhibits in detail, some



Evidence of progress made towards a solution of the alkali problem. White clover in foreground, salt-affected banks in mid-section and conserved fodder in background.

general comments are of interest. In the first place, all the exhibitors are concentrating on pasture or lucerne, and are all primarily interested in dairying: they require no convincing of the necessity for conserving their surplus feed, and display the progressive and enquiring outlook which characterizes the Victorian and New Zealand grass farmer of today.

Another noteworthy feature was the general insistence on the importance of quality in the lucerne and grass hay. On this basis hand-labour in cocking and stacking was preferred to the use of sweeps and stackers which would reduce the costs of production. The factor of area naturally operates against the use of these labour-saving devices, which can be put to more use on the larger paddocks of irrigators whose blocks include some hundreds of acres, as they do in adjacent districts. Stacking in the paddocks in which the hay is grown is the most useful application of this machinery, and on the small dairying block this would introduce complications. For example, stacks have to be banked off from irrigation, enclosed in a stock-proof fence, and later carted to some other paddock more convenient for feeding out or else carted to the shed.

As mentioned earlier, all the competitors were dairymen first and foremost, those who have taken up sheep having done so mainly because of the difficulties encountered to-day in expanding dairying activities, with success, beyond a herd which can be directly supervised on the home block. The lay-out of the blocks reflected appreciation of the value of numerous small paddocks each directly accessible from a lane, this system having proved most economical for carting-in and feeding-out of any fodders conserved and also allowing the most convenient application of some form of rotational grazing.

Protection from rain generally was poorly catered for. The very windy weather experienced last summer made it necessary to protect the tops of the stacks from being dislodged, and in most cases this was done by passing a length of fencing wire over the stack and weighting it at each end with a fence post or log. Now that wet weather has been experienced, this has proved rather unsatisfactory, as the water is likely in some cases to come in through the groove formed by the wire. The use of a length of cyclone or wire-netting similarly weighted would minimize this risk of spoilage, and at the same time would be more effective as wind protection. A further improvement would be to use some covering, such as a bag tarpaulin which has been sprayed with waste oil—this is an excellent cover for the purpose, and is cheaply made. It is not too late to make alterations of this sort. More care might also have been taken with some of the stacks, to keep them higher in the centre when building, and to prevent the uneven settling which lets the water in just above the eave.

Fire protection was good in every case as far as danger from engines, sparks from chimneys and so on were concerned, and all the yards

Fodder reserves on the property of Mr. A. E. Fenn, winner of the competition.

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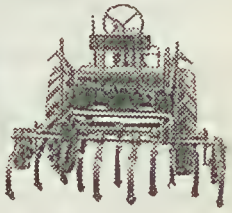

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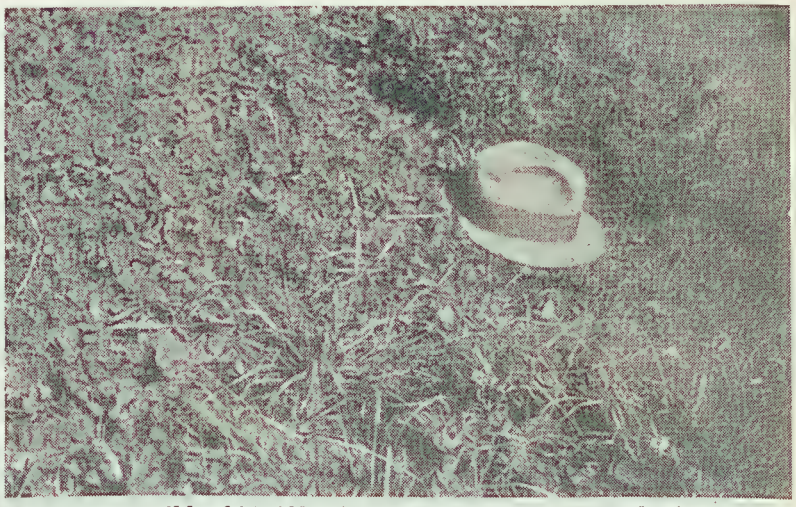
were situated at a sufficient distance from possible sources of fire. Although all stack yards were not free of heavy weed-growths which resulted from the February rains, all dry litter had been gathered up and in some cases used as a bottom layer of a stack. In one particular some improvement might have been effected as far as reducing fire-risk was concerned, and that was in regard to the spacing of the stacks. In most of the yards, if by any chance, such as overheating, one stack had ignited, the whole of the fodder conserved might easily have been lost. It is probable, however, that any possibility of over-heating would have been guarded against by building the doubtful stack at a safe distance or by baling. Close stacks along a much-used road, where they may be set on fire by some careless tramp using them as a camp for the night, would be inadvisable.

Protection from stock was thoroughly attended to in every case, and good fences and gates provided around the stackyards. Some stacks were built on stands fenced part-way on a side and an end, and formed useful pig-shelters, particularly in summer, while the stands were sufficiently high to keep the hay out of reach of the animals.



Irrigation wild white clover on the property of Mr. N. Harrower.

The Awards.

The winner of the competition, Mr. A. E. Fenn (Leitchville), exhibited five stacks representing cuts of lucerne in October, November, December, January, and early February. The first cut, classed as meadow hay, contained a good proportion of barley grass, white clover, and soft brome grass, and was fine and leafy. It was rather dull in colour, due to longer curing necessitated by the clover content. The second cut was coarser, with a little white clover and paspalum. The stack representing the bulk of the third cut was very good quality, particularly leafy and of a nice colour, with a fine stem. A little paspalum was included, and from a fodder value standpoint the cut could have been made a little earlier, lucerne at the full-flowering stage being reduced in quality compared with that cut in early flowering. The fourth and fifth cuts, which showed a discoloration and an admixture of pigeon grass, were otherwise of good quality, leafy and fine.

Mr. Fenn confines his attention to dairying, and at the time of the judging was carrying 47 milking cows, 3 dry cows, 12 head of young cattle (averaging 18 months old), 15 head from 6 to 12 months old, and 2 Jersey bulls, $3\frac{1}{2}$ and $2\frac{1}{2}$ years old respectively. The only sheep kept on the property during the irrigation season were 6 reared as pets and sold shortly before the judging. Horses were represented by 3 draughts and 3 lights, and pigs by 1 boar and 8 sows, all Large Whites, in addition to which an average of 25 to 30 stores are usually being fattened.

The block consists of 73 acres divided into 15 paddocks, all directly accessible from the farm lane, and including 20 acres of excellent lucerne, 10 acres of old lucerne containing a good deal of white clover; the balance, classed by the owner as "natural" pasture, forms a sward of very good permanent pasture due to the dominance of white clover and paspalum. An interesting feature is the contemplated replacement of paspalum with New Zealand perennial rye grass where possible, as the paspalum is considered to require trimming with the mower every month for best results.

Top-dressing at the rate of a bag of superphosphate to the acre is done in August, and on the average watering is done every three weeks during the season. Mr. Fenn prefers to cock the hay by hand, as raked cocks are considered too heavy to handle in the paddock and at the stack, and do not cure as evenly. Feeding-out is done on the ground on a dry corner about 200 yards from the stacks. Wastage is reduced to a minimum by putting out only a small amount

each time. If any baling is to be done, it is done by preference from the stack, and any water required for damping the hay is available from a channel running through one end of the stackyard, or from a windmill and tank on the channel. These might also prove useful in the case of fire.

Mr. Fenn's record with the Leitchville Herd Testing Association is something to be proud of For the first few years he occupied first, second, or third place, and latterly, owing to introductions of young cows, has been fourth or fifth. The herd averages have been as follows :—

Year	Cows.	Butter-fat. (average).
		lb.
1932–33	29	349·3
1933–34	29	354·2
1934–35	31	361·9
1935–36	27	393·7
1936–37	31	331·1
1937–38	44	365·4

With 56 days to go, one of his best cows—"Toreena"—had produced 486·7 lb. this year, and her daily output was still 1·84 lb. and her average test 5·6.

In spite of the high carrying capacity shown by the figures for stock and area, and the excellent performance of his cows, Mr. Fenn's paddocks still showed an abundance of feed, some of it in a fit stage for hay but unusable as such owing to the risk of poor curing, and in addition he had 23,790 cubic feet of hay in the stacks. This represented, on Mr. Fenn's estimate, about 90 tons. In the judge's estimate this was high, as it allowed an average of only 260 cubic feet per ton, but as other competitors gave estimated tonnages which worked out at about this figure it appears that the usually accepted figure of 300 cubic feet to the ton for new season's lucerne hay in stacks 12 to 13 feet high is excessive.

Mr. A. E. Fenn's "Toreena".

Second place in the competition was gained by Mr. H. Stone, Cohuna. Mr Stone is running dry stock on a separate block of 125 acres, but in this award only the produce and stock on the home block were under consideration. The home block covers 88 acres divided into 14 paddocks with paspalum and white or strawberry clovers as the main pasture species. Lucerne growing is now limited to two small areas, one of which was sown this autumn. Forty-seven cows, one of them dry, and a Shorthorn bull are carried in the autumn, with an average of 33 cows milking through the winter. Three draughts and a gig-pony, and seven sheep reared as pets, comprise the remainder of the stock carried. A small paddock of four acres in grass is permanently reserved for eight sows and a boar, and is kept grazed short throughout the year. Mr. Stone exhibited three stacks, one of good quality excepting some dullness in colour and consisting of a mixture of rye grass, white clover, soft brome grass, and subterranean clover, with a topping containing a higher proportion of paspalum. The other two stacks consisted of grass hay, with white clover, paspalum, &c., prominent in the mixture. Mr. Stone is also a believer in the superiority of hand-labour over machinery for hay-making and stacking.

Showing the securely fenced stackyard and stacks owned by Mr. N. Harrower.

[*Continued on page* 339.

The Business of Pig Raising

An Important Industry

By L. A. Downey, H.D.A., Pig Expert

This article is the first of a series which it is intended to publish in this Journal. Later articles will supply more detailed and illustrated information on the several phases of pig raising which are mentioned herein merely for their economic effect on the pig industry.

Productive breeding stock are the foundation of a good pig business.

PIG raising is practised by farmers as a means of marketing products of the farm, and when such foodstuffs are available and there is a favorable market for pigs, the business of pig raising can be profitable. Present conditions are very favorable for increased pig production in Australia. The home consumption of pig meats is very small and could be increased, but the first objective should be the supplying of a greater part of the £30,000,000 worth of pig meats imported by the United Kingdom annually; so far Australia supplies only about one-thirtieth part of that trade.

The policy of the British Government at present is to encourage home production of pigs by regulating pig and bacon prices on an economic basis, and then to allow Empire countries preference over foreign countries in the supply of pig meats to the United Kingdom. This policy has resulted in comparatively stable prices for pigs and bacon in the United Kingdom during recent years, and the stability has been reflected on the Australian market to some extent. There are indications that the United Kingdom market will remain fairly stable, and with an increasing part of Australia's pig production being exported to the United Kingdom greater stability might be reasonably expected on the Australian market, and so one of the most troublesome features of the pig industry in the past, i.e., price fluctuation, appears to be reduced considerably. This alone should encourage farmers to produce more pigs.

Another factor which should influence pig production is the availability of foods. It is the presence of dairy by-products which brings most farmers into the pig business, but there is a tendency for many farmers to treat pigs as no more than a necessary convenience for disposing of separated milk. When pigs are kept under such conditions of tolerance they are not likely to return the best possible results, and it is not surprising that disappointing returns are sometimes experienced by pig raisers.

The available milk by-products could be spread over a much greater number of pigs than are at present being produced in Victoria, if they were used in combination with greater quantities of grain, pasture, and forage crops.

Controlled experiments have shown repeatedly that a hundredweight (112 lb.) of grain fed in a balanced ration to good pigs will produce 20 lb. of dressed pork. Food costs usually amount to about 80 per cent. of the total cost of pork production, so that it will be seen that it is usually profitable to convert grain to pork. This fact is apparently not fully realized by dairy farmers who feed pigs mostly on milk, or by grain growers who sell grain and do not keep pigs. In the absence of milk a protein supplement such as meat meal can be used. Grain and meat meal used either with pasture or lucerne chaff provide a very satisfactory diet for pigs.

Bacon curers and pork exporters are able and willing to treat greater numbers of pigs, so, with the available food supplies and the United Kingdom prepared to take increasing quantities of Australian pig meats, it requires only the will of the farmer to increase production in this useful industry.

Stock.

In most circumstances farmers are able to breed their own pigs, and should do so in preference to buying store pigs, which practice should be avoided as far as is practicable, as most store pigs are bought on a high market and sold on a weaker market as porkers or baconers. An even more important fact is that the passage of store pigs through sale yards is probably one of the chief factors in the spread of disease in pigs. Not only is disease transmitted to pigs in trucks and sale pens, but also the pigs' journey to and from the sale, their cold and hungry experience during their stay at the sale yards, and their change of environment when they are taken to their new home, all tend to lower vitality and thus make the animals subject to infection which otherwise they may have been able to resist.

Having decided on the advisability of increased pig production, the farmer must consider the stock which will be most productive under his conditions. The best available breeding stock should be secured. Selected, pure-bred pigs are usually available from stud breeders at prices in the vicinity of £4 4s. 0d. each at four months old and £1 1s. 0d. per month thereafter, and provided they are selected on type, quality, development, and conformation as well as pedigree, pigs are not too expensive at these prices. Sometimes good sows of first cross or grade breeding are available at lower prices than pure-bred pigs, and these are frequently good value, but in all cases the best available pure-bred boar should be secured as he will have a greater influence on the progeny than will any one sow of the herd.

Pig raisers should decide whether they intend producing porkers or baconers and then specialize as far as practicable on the more suitable line. In this respect it is noteworthy that the Australian Meat Board made full inquiry into the possibilities of the export trade in pig meats, and, as a result, recommended that Australian exports of pig meats should be mainly in the form of frozen carcasses and pieces of baconer pigs, therefore, as any increased quantity of pig meats produced in Victoria is likely to be exported to the United Kingdom, growers should pay increasing attention to the baconer pig.

Growers should learn to recognize type irrespective of breed, and select breeding pigs of porker type or baconer type as desired. There are pigs for pork and pigs for bacon, porker type pigs being smaller in stature and reaching the right condition for slaughter at lighter weights than do baconers.

As the cost of pork production is influenced by the number of good pigs a sow rears each year, breeders should aim at establishing prolificacy in their herds. Prolificacy is inherited, but is also influenced by environmental conditions, such as feeding and management. The selection of breeding stock from prolific families is the surest way of getting productivity in a herd of pigs.

The milking capacity of the sow has a marked effect on the growth of her suckers, and like prolificacy, it is inherited and can be bred into the herd by selection, but to practise such selective breeding, records of production, such as the total weight of a litter when weaned from the sow, are necessary. In the absence of production records, breeders can only rely on their judgment by appearance, and when this is done it is wise to select both boars and sows which are well

Baconers ready for market.

grown for their age, long in the middle and have twelve or preferably fourteen well placed and well developed teats.

Management of the Herd.

Attention to details in pig management is reflected in increased returns from the pigs. The breeding capacity of gilts is sometimes impaired by mating them either when they are too immature or when they are too old and fat. It is difficult to be concise on this point but experiments and observations have shown that, provided gilts are in fair condition, being neither too fat nor too thin, they are ready to mate when about 250 lb. live weight. Gilts frequently come into season before they reach that weight and therefore should be kept apart from the boars.

Sows which have raised a litter, which is weaned when eight weeks old, usually come into season during the following week and if in fair condition should be mated then. Some sows come in season about three days after the birth of their litters, but unless they are rearing a very small litter it is not wise to mate them till after weaning. In fact few sows hold to service if mated at this time. When individual mating is practised it is usual to keep the boar separated from the sows and just join them for one service on the first day of oestrum and once again on the second day.

As an aid to efficient management, records, either in a book or on cards, should be kept of the service date of each sow, and 21 days later she should be watched to see if she returns for service. The expected farrowing date (114 days after service) can then be noted and the sow kept under observation as the time approaches. The checking of matings may prevent considerable loss of time and food by indicating sows which may otherwise be empty for long periods through having failed to hold to service.

A pasture paddock is the best place to keep pregnant sows, but they should be individually penned for farrowing, and care should be then taken with their diet to avoid constipation, as their exercise is restricted. The use of guard rails or farrowing crates for farrowing sows, to prevent them from injuring the newly born pigs, is generally considered advisable.

The sow's diet should be fairly light for a few days after farrowing but should be gradually increased until she is getting all she can consume when the litter is two weeks old. At this time the litter should be provided with food in a low trough or self-feeder in a creep away from the sow unless the sow is also being self fed. If dry feed is provided either water or milk must also be available to the suckers. Supplementary feeding continued throughout the suckling period increases the growth rate of the pigs and gives them an advantage which helps them right through their growing period.

Male pigs which are not required for breeding are best castrated a few weeks before they are to be weaned. If the operation is done at this time and a reasonable standard of hygiene is observed there is very little risk of infection or of a check in their growth.

Weaning is usually done when the pigs are eight weeks old, and, provided they have been feeding at the trough or self-feeder, weaning can be easily accomplished by reducing the sow's food and separating her from the litter.

In most circumstances it is advantageous to keep young pigs growing rapidly on a full ration at all times and it is considered that rapid growth immediately after weaning favours the development of the pigs' muscular system which in turn gives desirable lean carcasses. Weighing pigs at weaning time gives a measure of production which serves as a guide to the performance of the breeding stock and the management of the piggery. Production recording with pigs can be as useful as it has been with dairy cattle and poultry in increasing the producing capacity of the stock by providing information for selective mating and in indicating weaknesses in management.

Weighing pigs when they are nearing market weights helps the grower to market his pigs at the most desirable weights (near 100 lb. live weight for porkers and near 200 lb. live weight for baconers) and provides a further check on his enterprise. It is more important, however, to market pork and bacon pigs when they are in correct condition than at any particular weight as there is a demand for pigs of any weight if they are in prime condition, but there is no demand for pigs in unfinished or over-fat condition.

Keeping Pigs Healthy.

Disease causes a heavy economic loss to the pig industry, not only through the death of pigs on the farm or their condemnation after slaughter, but also to a greater extent by the insidious losses caused through slow growth in young pigs and lowered production in breeding sows. Health is a normal state in pigs, but when disease is present even to such a slight degree that it is not apparent to the pig raiser, they are not able to grow at their normal rate and are not able to convert their food to pork efficiently.

Most diseases which occur in pigs in Australia are preventable to a large extent by efficient breeding, feeding, and management. Inherent weaknesses in constitution are frequently intensified by careless selection of breeding stock; corrective mating should be practised to avoid this. Pigs are predisposed to many diseases by malnutrition, particularly when they are kept under intensive artificial conditions and deprived of their natural grazing environment.

Even when pigs are fed a ration which is balanced in respect to carbohydrates and proteins there are cases where the diet is deficient in certain minerals and vitamins which are essential to health. A heavy concentration of pigs on a small area tends to increase the risk of infection and so, under such conditions, a higher standard of hygiene and nutrition is called for. High producing breeding sows and fast growing pigs must have their environment, that is, their food and accommodation improved in keeping with their inherited capacity for production, otherwise a breakdown and disease should be expected. This explains some cases where improved purebred pigs succumb to conditions under which less productive pigs give a fair performance.

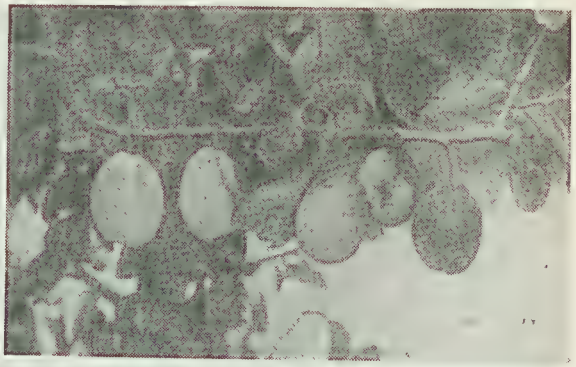
In the absence of special knowledge on nutrition, pig raisers can avoid many troubles by feeding ample and variety of wholesome foods and by running pigs on pasture. In accommodation, more than in any other aspect of pig raising, there is scope for improvement with the object of maintaining health in the pigs and thus reducing losses which have come to be considered by many as inevitable in pig raising. Protection from the extremes of cold, heat, and dampness is desirable, and therefore shelter is required. If, however, in providing that shelter the pigs are forced to live in places with insanitary floors which cannot be properly cleansed and disinfected, then more harm than good will result from such housing. When pigs are kept in small areas, i.e., intensively, they should have hard, impervious floors which are frequently cleansed and disinfected, the alternative being to provide paddocks which can be lightly grazed, stocked in rotation, and cultivated.

The grazing system of pig raising commends itself to Australian pig raisers and it has many advantages. Pasture is an inexpensive and health-promoting food. When sufficient paddocks are used in rotation and are stocked lightly the risk of disease and worm infestation is reduced, also the fullest use is made of the manure, a feature which alone may make the difference between profit and loss in pig production.

Pig raising provides a means of marketing cheap products of the farm and factory, but to ensure the greatest possible returns from this industry it is essential to use the best available breeding stock, give them a healthy environment and the necessary foods to complete and balance their diet; if any phase of these requirements is neglected returns will eventually be decreased. Pig raising to-day is an important industry that requires a special knowledge and is worthy of greater attention.

Export of Plums

An Experimental Shipment on the "Brisbane Star"



The Grand Duke variety which gave satisfactory results under the 32° to 45° F. temperature conditions.

IT is of interest to place on record the fact that on 1st February, 1939, the *Brisbane Star* left Melbourne for London with an experimental shipment of plums carried under very different temperature conditions from anything prevailing in the past. This shipment was arranged and carried out by exporters and growers at their own risk and was the outcome of experiments which have been conducted in Melbourne over several seasons* with the object of overcoming the disabilities associated with the export of plums.

Of recent years a small export trade in plums has developed from Victoria, and while quite good prices have been received for plums arriving in England in reasonably sound condition, yet it must be admitted that far too large a proportion either fail to ripen normally in England, or develop internal disorders shortly after discharge from the ship's refrigerated hold. The disorders usually develop, however, some little time after the plums have been sold. Such plums are, of course, of no value as a dessert, but are suitable for culinary purposes. Notwithstanding the fact that most of the plums are sold for culinary purposes, quite good prices are received for "out of season" fruit.

The experiments carried out in Melbourne showed that the failure of plums to ripen after discharge from cool storage, and the development of internal disorders was the result of storing the plums too long at 32° F. The period the various varieties could withstand at 32° F. varied enormously. Some Japanese varieties could withstand only a fortnight at this temperature. The European varieties could withstand considerably longer periods, mostly about a month, while one variety in particular, the Cole's Golden Gage, could withstand three months at 32° F. With the exception of a couple of Japanese varieties, it was found that when the main commercial varieties were stored together, a month at 32° F. was the limit, if normal ripening was subsequently to occur at 45° F., the atmospheric temperature to which the plums would be exposed in England, after discharge from the ship. Hence under the existing conditions of shipping plums (carried at 32° F. throughout the voyage of about six weeks), only one variety, the Cole's Golden Gage, can withstand this period at 32° F. without subsequently developing disorders. Those varieties which can withstand a month at 32° F. will develop slight internal disorders, while some Japanese varieties which can stand up to a fortnight only at 32° F. will develop severe internal disorders.

Experiments were conducted in Melbourne storing the main export varieties at (*a*) 32° F. continuously, and (*b*) at 32° F. for one month, after which the temperature was raised to 45° F. After eight weeks the "(*a*) lot" failed to ripen and developed disorders while the "(*b*) lot" ripened with full development of juice and flavour with no development of disorders. Some of the leading exporters who took a personal interest in the experiments were so convinced of the superiority of the "(*b*)" conditions of storage over the "(*a*)" conditions, that they prevailed upon the plum committees of the Victorian Fruit Marketing Association and the Fruit Exporters' Handling Committee to forward an experimental shipment of plums to London under the "(*b*)" conditions.

The shipment was arranged and forwarded on the *Brisbane Star* and consisted of approximately 1,800 cases. In view of the fact that plums prior

* Victorian Plums and Peaches—Cool Storage and Export by—{ G. B. Tindale, B.Agr.Sc. / F. E. Huelin, B.Sc. Ph.D. / S. A. Trout, M.Sc., Ph.D. } *Journal of Agriculture*, Vic., Dec., 1938, p. 609

to shipment are pre-cooled at 32° F. and that, sometimes, plums may be held in cool storage up to a fortnight awaiting shipment, it was considered safe to assume that the experimental plums had already been subjected to a fortnight at 32° F. before shipment, and hence it was arranged that they be carried on the *Brisbane Star* for a fortnight at 32° F. (making in all four weeks at 32° F.), after which the temperature was to be raised to 45° F. The *Brisbane Star* took six weeks to reach London, hence the period on board ship at 45° F. was four weeks. Actually very few of the plums were held in Victoria at 32° F. awaiting shipment for more than a week, so that the period on board ship at 32° F. could have been increased to at least three weeks and hence the period at 45° F. decreased to three weeks. This would have had a considerable effect in landing the plums in a less forward condition than what actually occurred. In addition to the experimental consignment of plums the *Brisbane Star* carried a fairly large commercial consignment under the usual conditions of 32° F. throughout the voyage. Several growers had similar lines of plums in both the experimental and commercial lots.

On arrival of the *Brisbane Star* in London, the plums were promptly discharged and hurried to the markets for immediate sale, for selling agents know by past experience, that unless immediately sold, the plums are likely to develop severe internal disorders, in which condition the plums are scarcely saleable. When offered for sale, direct, from the ship, the commercial lots were in a hard, very firm condition, whereas, as anticipated, the experimental lots were commencing to ripen, and were therefore somewhat soft to the touch. As matters are at present the selling agent simply cannot tell how the plums will behave after they leave his hands—that is whether they will ripen normally or develop disorders. However it is only natural for the selling agent to assume that the firmer plums from the commercial consignments would "hold up" better than the somewhat softer plums from the experimental consignments, and from reports received it appears that the selling agents therefore placed a higher value on the commercial lot than on the experimental lot. Prices actually received showed that the commercial lot realized on the average about 2s. per case more than the experimental lot, and if price received is to be regarded as the criterion of success or otherwise of the experiment (and in many people's opinion this is the only criterion) then the experimental shipment must be regarded as a failure.

It was fully realized, however, that the true value of the experimental plums would become manifest only some days after discharge from the ship (by which time the plums were sold). It was expected that the experimental plums would continue to ripen normally without becoming over-ripe at the prevailing English temperatures while the commercial plums would gradually develop internal disorders. From reports received from officers attached to the Victorian Agent-General's office, London, and Australia House, London, and also from the London representatives of some shippers, it was learned that such conditions actually did prevail. These reports are fully quoted below. Hence technically the experiment was a success insofar that the superiority of shipping under the 32°–45° F. system of temperatures as compared with the usual 32° F. was demonstrated, but as stated above, this superiority became manifest only some time after the plums were sold, and was not reflected in the prices received. Indeed on account of the fact that ripening had commenced in the experimental plums they were regarded with suspicion, and were sold at prices less than the commercial lot.

Oversea Reports.

At this stage it is desirable to quote the reports received from London from those people who followed the plums through the markets and who were able to compare the outturn of the two lots. **Mr. S. McColl,** Commercial Officer attached to the Victorian Agent-General's office, London, reports as follows:—

"The carriage of plums at the combination of temperatures, 32°–45° F. shows very promising results, and in certain varieties a marked improvement in condition when compared with the same varieties carried at 32° F. Generally the plums carried at 32°–45° F. arrived in a sounder condition, being freer from internal disorders than those carried at 32° F., and while they were mainly more forward in condition, they continued to hold that condition for some days without any perceptible change, and at the same time developed a little juice and flavour. This improved condition was particularly noticeable in the President variety carried at 32°–45° F., which showed minimum flesh injuries while those carried at 32° F. showed severe injection, a condition in which the flesh of the plum is glassy in appearance, and which subsequently becomes soft and bladdery, with a brown mealy flesh.

Two similar Japanese varieties, Premier and Narrabeen, shipped at 32°–45° F. also arrived in

good condition, showing good colour free of internal injuries, were juicy, and of a very fair flavour, while the same varieties shipped at 32° F. throughout opened up in a very firm condition, but showed moderate to severe internal browning of the flesh. Later the flesh became darker and failed to develop any flavour. Although the latter were faulty, they showed externally a sound appearance and were sold for 9s. to 11s. per box.

Grand Dukes shipped at 32°–45° F. opened up, with one or two exceptions, in a satisfactory condition. Colour was mostly full, and flesh firm to very firm. Most lots examined were free or nearly so from internal flesh defects, but some showed a slight to moderate browning of the flesh. The sound plums held their condition well on the markets, showing very little change in appearance, although they were more advanced in maturity than those carried at 32° F.

A plum orchard in the North East.

General Condition of Plums Carried at 32° F.

The condition of the plums carried at 32° F. was much the same as those which have been landed here in previous years. All varieties showed the injected condition of the flesh to a more or less degree (sometimes the flesh was brown). The Grand Duke generally was less affected by this injury than other varieties, but not consistently so. Many of the Presidents in this shipment were more seriously affected with the internal injected condition than I have noticed before. The whole flesh had a dark green glassy appearance, which after a week on the market had commenced to brown. The flesh was soft and bladdery and the plums were exuding juice from the stem eye.

Prices Realized.

The chief factor influencing the buyer of plums is the knowledge of how long the plums will keep before losing condition, and this aspect, obviously, is also the anxiety of the merchant. The plums which will sell first to the discerning buyer are those which appear to have the longest life, and if plums are showing a backward condition against a more forward condition in other samples alongside, the buyer wants the former. This was the position in respect to the experimental plums. Although many were in a firm condition, they were generally riper with more colour than the sound or apparently sound plums out of the 32° F. chamber, which were very firm to hard. The experimental plums developed a better quality, but in this shipment that factor did not result in any advantage in price, as the best conditioned lots from both the experimental chambers and the ordinary cold storage realized about the same prices. I am of the opinion that when further consignments of plums are shipped under the combination temperatures, it would be an advantage if the plums could be landed in England in a more backward condition."

Dr. T. H. Harrison, Fruit Officer attached to Australia House, London, made an inspection of the experimental and commercial consignments of plums from the *Brisbane Star*, giving particular attention to the behaviour of the plums in the markets. Dr. Harrison reports as follows:—

"The condition of the plums on discharge from the experimental chamber was generally satisfactory, the fruit being relatively forward, but sound and firm, and free from internal browning or glassiness indicating low temperature injury. From the ordinary chambers the plums were discharged in a much greener condition mainly firm and sound, although some showed evidence of severe low-temperature injury. In the markets where the fruit was delivered on the afternoon of discharge, the condition was much the same as that observed at the docks.

Detailed examinations of fruit were made at Messrs. T. J. Poupart, Dan Wuille, S. M. Machado,

T. Walton, Minear, Munday and Miller, J. O. Sims, M. and W. Mack, E. H. Lewis, and Dennis and Cooper's. In the majority of instances the salesmen preferred the fruit ex ordinary refrigeration, contending that the fruit ex the experimental chambers was too far advanced for provincial trade, and in some cases so ripe as to necessitate its quick sale to a lower class of retailer. The following varieties were examined:—President, Grand Duke, Jefferson, Golden Drop, Narrabeen, Satsuma, Pickering, Cole's Golden Gage and Greengage. The condition was most variable, but in general those ex the experimental chambers, while considered too ripe by the salesmen, were in superior condition to those ex ordinary refrigeration. This was particularly noticeable with the Grand Duke and the President, which constituted 75 per cent. of the consignment.

At Messrs. Dennis and Cooper, S. M. Machado, and Dan Wuille's, large quantities of these varieties were examined. The salesmen stated their desire to get rid of the fruit as quickly as possible, being afraid of the development of internal injection and collapse, which invariably developed in fruit ex the ordinary chambers once it thawed out properly. At J. O. Sim's, the fruit ex the ordinary chambers was commencing to show flabbiness and collapse. At T. J. Poupart's, parallel consignments of these two varieties ex experimental and ordinary chambers were examined in detail. The fruit ex the experimental chamber had a good bloom, was sound but soft ripe, whereas that ex the ordinary chamber was dull in appearance, internally injected, or very mealy and shrivelled. At E. H. Lewis's, the fruit from both chambers appeared much the same externally, having a high colour, being relatively sound and showing little shrivel. That from the ordinary chamber was a little more injected and a little more mealy than that from the experimental chamber. At T. Walton's, one special line of Grand Duke forwarded under ordinary storage was examined. The appearance was very good, the fruit having a very high colour and apparently sound, but a percentage of fruits showed mealiness and injection.

One line of Narrabeens ex ordinary chamber was examined. This fruit was of good appearance generally, but the internal condition was poor, the fruit being dry, flavourless, and rubbery in texture. The fruit was all sold at prices which averaged 9s. 6d. per box of four punnets, and therefore, the consignment must be considered a commercial success, but in contrast to the same variety of plum shipped in the experimental chamber, this fruit was thoroughly unworthy to be sold as Australian produce.

The Narrabeen ex the experimental chamber developed full plum flavour and plenty of juice, while the colour changed from pink to red, while some of the fruits held in a sound condition for almost three weeks. It is suggested that this plum, which in the past has failed to ripen, is one of such promise when forwarded under conditions such as prevailed in the experimental chambers, as to warrant its being packed in trays containing not more than two layers of fruit. President and Grand Duke plums purchased and held for detailed examination developed 100 per cent. internal breakdown from the ordinary chambers and practically none from the experimental chamber."

Summary and Conclusions.

(The following summary and conclusions are those of Dr. Harrison.)

"It is clear from the above details that the plums carried in the experimental chambers were in general very much superior in real plum condition to those carried under ordinary refrigeration. It is true that some of the fruit was too forward to suit the market requirements, and equally true that the plums which were still in good condition, being sound, firm, and capable of lasting in marketable condition for upwards of a fortnight, were not well received by the salesmen. The fruit ex ordinary refrigeration was in general less mature in appearance, and fitted in with the salesmen's conceptions of what the condition should be on discharge.

It is apparent, however, that a plum trade built on blatant deception can never become very extensive, nor establish good-will for Australian products. Despite the fact that commercially the transport of plums under ordinary refrigeration conditions is considered a success, it is such a technical failure that serious consideration should be given to the prohibition of all export, under the old methods of refrigeration, of plum varieties known to be incapable of standing the period normally necessary for transport from Australia. The trade in plums is as yet only a limited one, bringing profit to a very few at the risk of prejudicing Australia's chances of building up a really substantial trade in this fruit. Inasmuch as the South African Deciduous Fruit Exchange has already commenced to educate salesmen and buyers to a realization of the fact that fruit carried at the higher temperatures and apparently arriving in a forward condition is an infinitely superior product, with a real plum appeal to the public, it would not take Australia long to educate salesmen and buyers along similar lines."

Through the courtesy of the Southern Victoria Pear Packing Co. Ltd., which company shipped a large proportion of the experimental plums, the remarks of their own London representative, **Mr. F. J. Garford,** are made available. Mr. Garford states "the experimental fruit was all in a more or less ripe condition, but the plums had ripened normally and were full of juice, a good flavour, and when cut showed the natural colour. Those carried under the usual conditions were without flavour and when cut were mealy and discoloured. When ripening they quickly turn wasty and bladdery. Another very noticeable comparison between the two consignments was that where the fruit from the experiment was cut, the stone would come away in the manner of a perfect slipstone, but I have never seen this possible with plums from the usual conditions. Taking this shipment as a whole, I consider that a very useful purpose has been served, inasmuch as we have received Victorian plums which have retained most of their natural flavour. This has never been achieved before and it leads me to hope that consignments will eventually be landed which are not quite so forward in condition, but in which the fruit will have still retained its natural qualities.

To me the most remarkable feature of the plums which were the subject of this experiment was the fact that they did not become any riper a fortnight after discharge, when kept in a temperature of 45°. I had the opportunity of inspecting plums from this shipment in the Covent Garden Laboratory a fortnight from the date of arrival, and I must admit that I was astonished at the condition of the fruit from the experimental chamber as compared with the other. I will give a few comparisons of what I saw:—

Narrabeens (a Japanese variety from Shepparton).

From experiment and held at 65° for a fortnight after discharge. Dead ripe, but full of juice and flavour.

From experiment and held at 45° for a fortnight after discharge. Nicely ripe and a perfect flavour.

From ordinary conditions and held at 45° for a fortnight after discharge. Wasty, mealy, and flavourless.

Grand Dukes.

From experimental chamber and held at 65° for a fortnight after discharge. Dead ripe, juicy, and perfect natural flavour.

From usual conditions and held at 65° for a fortnight after discharge. Had been thrown away.

From experimental chamber and held at 45° for a fortnight after discharge. Nicely ripe, very juicy and full flavour.

From usual conditions and held at 45° for a fortnight after discharge. Wasty, mealy, and flavourless. Cut brown inside.

Presidents.

The same remarks apply to Presidents as to the Grand Dukes and an exactly similar comparison between the two methods can be made.

Taken as a commercial proposition, the experiment has not been a success as the realized prices will average at least 2s. 6d. per half-case below those carried under the usual conditions, but at the same time, I consider that it has been a technical success and the information gained will no doubt be put to good purpose in the future. Personally I consider it the greatest forward move in the export of plums since I have been connected with the industry."

Cole's Golden Gage Plum

By C. F. Cole, Senior Orchard Inspector.

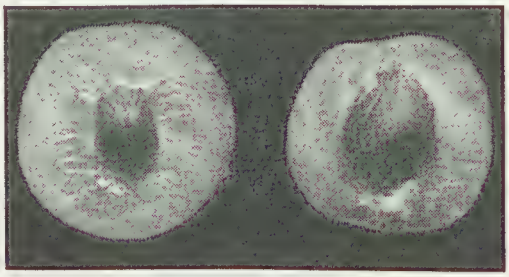
THE outstanding behaviour of the Cole's Golden Gage plum for cool storage and export has already been demonstrated (1).

Briefly this plum is quite outstanding in as much as it is able to withstand very long periods at 32° F. (up to three months) and subsequently ripen normally, whereas the limit at 32° F. for most other European varieties is about a month, and when stored beyond this period (as is necessary for export), they either fail to ripen on removal from cool storage or develop various forms of internal disorders. The consequence is that Cole's Golden Gage plum exported under the prevailing conditions of 32° F. throughout the voyage will ripen normally after discharge from the ship whereas most other varieties will not. This fact is well reflected in prices received, for the Cole's Golden Gage invariably sells at highest prices. Though efforts are being made (2) to vary the temperature conditions on board ship with the object of landing other varieties so that they will ripen normally after discharge, the Cole's Golden Gage still has the advantage of having the longest storage life and ripening with a quality not surpassed by any other variety after prolonged cool storage.

History.

This plum was raised by the late Thomas Cornelius Cole, one of the pioneers of horticulture in Victoria, who in 1845 established an orchard and nursery on land having a frontage to the river Yarra close to the Victoria-street Bridge, Abbotsford. A keen plant hybridist who recognized the want in the Colony for new varieties to meet local requirements, Cole set to work to achieve his objective. Records in horticultural history prove his success in the raising of new varieties of fruits.

Selecting pollen of the Cole's Golden Drop as the male parent, Cole pollenized the flowers of the English Green Gage variety. The seedling plums raised from this cross did not fruit at the Abbotsford nursery but were dug up and transplanted to a site at Upper Hawthorn, which later became known as the Twyford and Shorland orchards and nurseries, where they produced fruit. A selected Golden Gage seedling plum from this cross was named in 1864 Cole's Golden Gage.



Cole's Golden Gage.

Description.

The fruit is of medium size, round, one side is enlarged with a distinct suture extending from the stalk to the apex. The stalk is short, stout, averaging half an inch long, and set in a medium cavity. The skin is a golden yellow with a thin white bloom. The flesh is yellow, adheres slightly to the stone, is very sweet, juicy, luscious, and highly flavoured, and the ripening season is the end of February.

Nomenclature.

During 1881 the late William Lawford purchased young trees of this Golden Gage from Cole's nursery and planted them in his orchard situated at Box Hill. Later Mr. Lawford removed to Winton Swamp, near Benalla, and established an orchard there, thus introducing this plum to the north-east of the State. In 1890 Mr. A. F. Thiele, a pioneer orchardist of the Doncaster district obtained scions of this variety and established it in his orchard. Also the late J. Oliver of Tunstall planted trees of this gage, purchased from Cole's nursery, in the year 1900. Eventually this plum became a popular variety and was widely planted. In more recent times, however, as plums became, on the whole, unprofitable to grow, and as the change over from light to dark varieties for factory purposes took place, this golden plum became less sought after until at present it is not very well known by the younger growers.

(*Continued on page 340.*

All-Australian Export Lamb Competitions

Final Results 1938-39 Season

THE judging of the February entries concluded the 1938-39 series of the All-Australian Export Lamb Competitions conducted by the Australian Meat Board in London, and the judge, Mr. J. I. Hamilton, has announced final placings and awards as follows:—

All-Australian Grand Champion—Agricultural College, Roseworthy, South Australia (Entries No. 5 and 26). *Points,* 190. *Class I.—Champion and First Prize.*—Agricultural College, Roseworthy, South Australia (Entries No. 5 and 26). *Points,* 190. *Class I.—Second Prize.*—W. H. Newman, South Australia (Entries No. 27 and 21). *Points,* 186. *Class I.—Third Prize.*—T. Ridgway, South Australia (Entries No. 41 and 45). *Points,* 184. *Class II.—Champion and First Prize.*—W. S. Kelly and Son, South Australia (Entries No. 1 and 3). *Points,* 186. *Class II.—Second Prize.*—J. H. Dawkins, South Australia (Entries No. 19 and 25), *and* C. L. E. Orton, Western Australia (Entries No. 15 and 16). *Points,* 160 (Messrs. Dawkins and Orton divide 2nd and 3rd prizes). *Class II.—Fourth Place.*—A. T. Hill, South Australia (Entries No. 18 and 28). *Points,* 154; *and Class III.—Champion and First Prize.*—H. H. Shillabeer, South Australia (Entries No. 72 and 73). *Points,* 144.

The number of entries judged were, in Class I., 134, in Class II., 15, and in Class III., 2, a total of 755 carcasses or 55 more than in the first series. In addition, twelve entries comprising 60 carcasses were displayed and judged on account of the State Meat Board of Tasmania. The entries were made up as follows:—

——	Class I.	Class II.	Class III.	Total.
South Australia..	69	9	2	80
Western Australia	20	3	..	23
Tasmania ..	21	..	..	21
New South Wales	11	..	..	11
Queensland ..	10	..	..	10
Victoria ..	3	3	..	6
Total ..	134	15	2	151

The modification of the conditions and Classes had so little practical effect, except perhaps as far as Tasmania was concerned, that a direct comparison can be made with the previous series of competitions.

The highest number of points awarded to a single pen—96 (in Class II.), and the highest aggregate of two pens—190 (in Class I.) were two and three respectively below the maximum of the first series but the standard of quality, nevertheless, was a high one. In fact, it was higher except, practically, in the case of Tasmania, whose State Competition provided some particularly good pens and one of two outstanding carcasses of the year. This particular carcass was purchased on behalf of the Argentine Meat Board in preference to a New Zealand show lamb purchased previously, and is serving as a model for Argentine producers.

In Class I., of the 134 entries 96 scored 75 per cent. or over of the possible points. Twenty-six scored between 70 and 74 and none below 60. In Class II., of fifteen pens, ten scored over 75 per cent. of the possible total, two scored between 70 and 74, and three scored only 50 each. Two pens scored 96 and 90 respectively and, in fact, the former (entered by W. S. Kelly and Son, South Australia) for which, as a pen, praise could scarcely be too high, gained the highest number of points in the series. It should be noted, however, that in Class I. the pen would not have scored so highly. In Class III. there was only one entry (two pens). These were a useful type, but it cannot be too clearly stated that the sires eligible to compete in Class III. have not the attractiveness of the Downs and are not the type to compete in the high-class trade.

South Australia made practically a clean sweep of the awards. Where so many factors besides breeding enter into the calculations, it is unsafe to generalize, but the outstanding success of the Dorset Horn crosses in the breeding of so many of the leading entries is most interesting and significant. The indications are, in fact, that provided the lambs are taken at a very early stage they may be relied on to prove most attractive in the highest class of trade.

In point of numbers (only three pens each in Class I. and Class II.), entries from Victoria were most disappointing and the entries in Class II. were not up to show standard, scoring only 50 points each. Nevertheless, the three Class I. entries (of Messrs. R. B. Mills and Son) averaged 88 per cent. of the maximum possible and one carcass (Entry No. 4, October) which was specially selected for block testing purposes was probably the best carcass of the competitions. There was some difference of opinion as to whether this carcass, or the Tasmanian State Competition entry referred to previously, was the better, but the considered opinion of Mr. J. I. Hamilton, the judge, is that while the Tasmanian lamb, of which the legs are better filled, may be regarded as a super lamb, that bred by Messrs. R. B. Mills and Son is, for practical trade purposes, ideal. Subsequently, it has been established that Mr. Hamilton's judgment was correct, and a series of illustrations and tables arranged under the supervision of Dr. Hammond, in carrying out the block tests, will be available at an early date.

In deference to the convenience of the market, particularly that of stall holders opposite to where a display is made, the competitions have been held without a great deal of show, but it is safe to say that they have been followed with much interest. Furthermore, displays which have been made after judging, notably by Messrs. Selfridge, and in other retail establishments, were a splendid advertisement for a greatly improved type of Australian lamb which is becoming more readily procurable.

Glasshouses for Tomato Culture

(*Continued from page 322*)

inside. The formula at the end of this paragraph will be found cheap and efficient; it will not etch the glass as so frequently occurs from the use of various lime mixtures. In addition, it may be applied easily with an ordinary spray pump, and if so desired, as easily removed if first sprinkled with the hose or a damp day chosen for the purpose. The mixture is as follows:—Mix 2½ lb. flour with 3½ gallons of cold water, then add the following:—½ lb. flour boiled in 2 quarts of water until transparent (like making gruel or cornflour). This mixture will not wash off with the rain.

Preparation or Renovation, of Soil for Glasshouses.

The soil for glasshouse culture should be thoroughly enriched. Five or six good drayloads of very old cow manure is not too much for a standard glasshouse. If the soil is inclined to be heavy, a few loads of sand and leaf mould might be added. A double handful of six parts of superphosphate to four parts of blood and bone and one part of potash should be used for each six or eight small plants, and two or three side dressings of three parts of superphosphate, plus one part of sulphate of ammonia or nitrate of soda, will produce excellent results.

In one lot of 12 standard glasshouses near the Murray River, as much as three bags of blood and bone per house are used with excellent results. It will be noted that the manurial recommendations for glasshouses differ somewhat from those for ordinary field plantings. This is because the solids ratio of the tomato is detrimentally affected when the fruit is forced by applications of quick-acting nitrogenous fertilizers.

With glasshouse tomatoes this is not so important, because the fruit is not usually produced for factory purposes. Apart from the above treatment, the ideal manure, and the warmest to use in a glasshouse for those fortunate enough to obtain it, is sheep manure. This normally is warmer than most animal manures, and is recommended, especially for winter use.

For those who desire to use poultry manure, four to six kerosene tins full would be an ample dressing for the standard glasshouse. Superphosphate is a good artificial fertilizer to combine with this manure.

Fodder Competition

(Continued from page 326)

A different method of feeding out the hay is practised at Mr. Stone's. Four paddocks are selected, and hay is carted out to them every second day. The cows are left in each paddock for a day and a night. By continuing this process each paddock is eventually used for the feeding and the clover seed in the hay is distributed over the property. Paddock growth is good, and the pastures are kept in vigorous growth by an annual top-dressing at the rate of one bag to the acre and watering about every three weeks during the season. Mr. Stone is not linked up with any herd testing association at present, and figures for production were not available, but the excellent condition of his herd testified to good feeding. Furthermore, 70 head of cattle have been fattened and sold since the February rain.

The stacks, aggregating 70 tons, were in two yards, to facilitate the utilization of the hay under the rotational system described, and in each case the yards were securely fenced, safe from irrigation water and flooding, and at a safe distance from possible sources of fire. No coverings were used, and in common with most of the stacks inspected no provision against wastage at the base was made except to clean up the yard and use the litter as a foundation.

Mr. N. Harrower (Gunbower Island) was awarded third place, and exhibited four stacks of lucerne and a mixture of lucerne, white clover, soft brome, &c., aggregating 40 tons. These were all hand-built, the hay being mowed, raked both ways, and carted within two or three days depending on the weather. Lucerne has been the only seed sown on the 42 acres, which includes three acres of sheds, yards, garden, and lanes, and is subdivided into eight paddocks. Sixty-two head of cattle, 22 of them poddies and heifers, are carried, and of the 40 cows in the herd 29 were milking at the time of the judging. The bull is a three-year-old Shorthorn. No sheep are carried, but horses are represented by 1 heavy draught, 1 light draught, and 1 yearling. Herd testing is not followed, but the cows were stated to have averaged 1¼ lb. per day for the five months up to mid-April.

Mr. A. Morris' fodder reserves.

The soil of this block—a sandy ridge which still carries a few tea-trees—is very fertile and particularly adapted to the growth of irrigation wild white clover, in fact this plant, which Mr. Harrower prefers to lucerne, has been so prolific

FODDER CONSERVATION COMPETITION, COHUNA, 1938–39.

Exhibitor.	Suitability and Quality.		Location and Protection in regard to—		Economy of Production.	Carrying Capacity.		Excess.	Totals.
	Suitability.	Quality.	Fire, Flood, Economy in feeding, General access.	Weather, Pests, Stock, Deterioration.		Paddock growth.	Food units cf. Stock units.		
Possible Points	30	35	10	20	20	10	40	35	200
A. E. Fenn, Leitchville..	29½	34	8½	17½	19	9½	40	25	183
H. Stone, Cohuna ..	28½	34½	7½	18	19	8½	40	10	166
N. Harrower, Gunbower Is.	29½	34	8½	18	19	9	26	..	144
A. Morris, Horfield ..	28½	33½	8½	18	19	6	26	..	139½
T. E. E. Bond, McMillans	29	34	8½	18	19	8	22	..	138½
T. G. Farrant, Cohuna..	25	33½	9½	19½	19½	7	22	..	136

Two stacks of grass hay on the property of Mr. H. Stone, who gained second place in the competition.

in growth that it is impossible to maintain a pure lucerne stand for any length of time. Some idea of the natural fertility under irrigation will be gained from the fact that in addition to the 40 tons conserved for the winter, and excellent paddock growth, 30 tons of hay were sold for £5 per ton in the stack.

The stackyard is securely fenced with cyclone and two barbs which effectively bar horses and cows from damaging the stacks. Mr. Harrower, however, makes a practice of running one or two sows in the stackyard and these have been busy at the base of each stack, spoiling their appearance to some extent. From the standpoint of health of the pigs, however, this practice has given excellent results. Protection from fire and irrigation water has been thoroughly attended to, with the exception that the stacks are very close together; no coverings are provided, and some mouldiness and discoloration was evident in parts of the earlier-built stacks as a result of the February rains.

In general, leafiness, colour, and aroma were good, and the main defect was coarseness. In one small stack spear thistle was conspicuous and effectively discouraged any prolonged investigation of the interior. The fodder is chaffed for bail-feeding, using a small cutter driven off the engine of the milking machine. In addition, some is fed as hay in an adjoining paddock.

COLE'S GOLDEN GAGE PLUM *(Continued from page 336).*

Through cool storage experiments conducted by the Department of Agriculture, the export of fresh plums to England has grown considerably of late and the long cold storage life and shipping qualities with high prices obtained in London have been the means of bringing this old variety to the fore as a shipper. This plum has been exported under three names—Lawford Gage (L.G.), Golden Gage (G.G.), and Cole's Golden Gage (C.G.G.), and it seems desirable that the history of this variety should be set down so that the priority of the name Cole's Golden Gage should be clearly established and any confusion arising from the multiplicity of names be guarded against.

In latter years there has been a tendency to tack a name on to an old-named variety simply because such a variety has been fancied and planted by a particular grower in a particular locality, not knowing that such old variety has already been named. To some extent these conditions are being corrected by the authorities controlling the export of our fruits, e.g., Munroe's Favorite apple must be shipped as Dunn's Seedling, and Stewart's Seedling as Ballarat. This is a step in the right direction, otherwise priority relative to the correct fruit names will drift and bring about chaotic conditions in Australian pomology. To allow such a condition to continue would not be fair to past pioneers of the industry, and I am sure that no one will begrudge to the originator of the plum Cole's Golden Gage the appropriate tribute of correct nomenclature.

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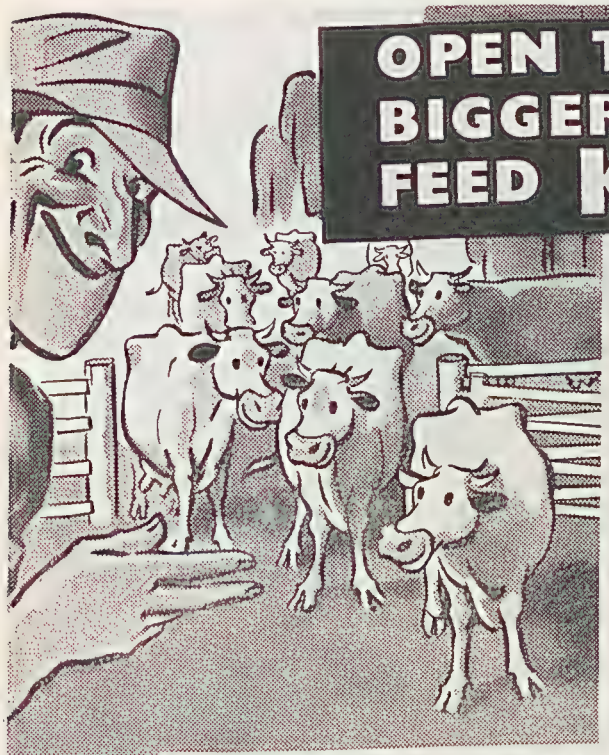

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DO. 39/11.

Poultry Feeding Tests, 1938-39

Results at Werribee

By W. O. Pederick and A. G. Clark

EXTENDING over a period of twelve months from the 1st April, 1938, to the 31st March, 1939, poultry feeding tests were conducted at the State Research Farm, Werribee. For the purpose 500 pullets were used, consisting of five pens of Australorps with 50 birds in each pen, and five pens of White Leghorns with 50 birds in each. All the birds were kept confined, i.e., there was no outside run, although succulent green feed was supplied regularly and shell grit was always available. Owing to hot dry weather and the shortage of water, green feed was very scarce for several months.

The object of these tests was to determine, if possible, the amount of meat meal which, when added to dry mash, would give the best results for egg production. The dry mash which was the same in each pen with the exception of the meat meal, consisted of bran 1 part by weight, pollard 2 parts, salt 1 per cent. Ten per cent. meat meal is the amount generally used, but in these tests the following percentages were added to the mash:—Nil, 5 per cent., 7½ per cent., 10 per cent., and 15 per cent. The meat meal which was used is registered under the Stock Foods Act as containing 63 per cent. protein, but samples of this product, analysed during the year, in each case showed a higher percentage of protein than that guaranteed.

The dry mash was always available to the birds. The grain mixture, which consisted of wheat 3 lb. (3 parts by measure), oats 9 oz. (1 part), maize 12 oz. (1 part), and barley 12 oz. (1 part), was fed in the litter each afternoon at the rate of 6½ lb. per pen (approximately 2 oz. per bird).

The accompanying table gives particulars of the food consumed, the eggs laid, and their value, the profit over food cost, and the mortality in each pen. The cost of food was arrived at by taking the wholesale prices published in the press weekly, and all eggs laid were valued at the top wholesale prices. No deductions have been made for marketing charges, &c. Those birds that died were replaced.

Results.

Notwithstanding the fact that the rations varied so much in analysis, the egg production

was consistently good throughout the test, showing an average of 195·2 eggs per bird for the 500 birds. The difference in production between the highest and lowest pens in both Australorps and White Leghorns was approximately 12 eggs per bird.

In the Australorp section the highest production, and also the highest profit over food cost, was in Pen No. 3 (7½ per cent. meat meal) with 197·6 eggs per bird, followed by Pen No. 5 (15 per cent.) with 192·8 eggs, Pen No. 1 (no meat meal)—186·2 eggs, Pen No. 2 (5 per cent.)—186·2 eggs, and Pen No. 4 (10 per cent.) with 185·9 eggs.

In the other section (White Leghorns) the highest production, and also the highest profit over food cost, was in Pen No. 10 (15 per cent. meat meal) with 207·1 eggs per bird, followed by Pen No. 7 (5 per cent.) with 201 eggs, Pen No. 9 (10 per cent.) with 199·9 eggs, Pen No. 8 (7½ per cent.) with 199·9 eggs, and Pen No. 6 (no meat meal) with 195·6 eggs.

It is interesting to note that the consumption of mash generally was lower in the pens which received the higher percentage of meat meal, notwithstanding the fact that the production generally was higher in those pens. This would indicate that the higher protein content of the

TEST NO. 19.—WERRIBEE FEED TESTS—1ST APRIL, 1938, TO 31ST MARCH, 1939 (12 months).

Pen No.	50 Pullets in each Pen.	Mortality. (Birds died.)	Bran.	Pollard.	Meat Meal.	Wheat.	Oats.	Maize.	Barley.	Total Food.	Cost of Food.	Total Eggs.	Value of Eggs.	Profit over Food Cost.
		No.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	£ s. d.	No.	£ s. d.	£ s. d.
1	Australorps—Dry mash, no meat meal	4	777	1,553	..	1,406	264	351	351	4,702	15..9 0	9,312	54 5 6	38 16 6
	Average	..	..	..	..	..	..	..	..	**94·0**	**0 6 2**	**186·2**	**1 1 9**	**0 15 7**
2	Australorps—Dry mash, 5 per cent. meat meal	3	699	1,397	110	1,406	264	351	351	4,578	15 6 0	9,309	54 6 8	39 0 8
	Average	..	..	..	..	..	..	..	..	**91·6**	**0 6 1**	**186·2**	**1 1 9**	**0 15 8**
3	Australorps—Dry mash, 7½ per cent. meat meal	3	687	1,374	167	1,406	264	351	351	4,600	15 9 11	9,882	58 7 8	42 17 9
	Average	..	..	..	..	..	..	..	..	**92·0**	**0 6 2**	**197·6**	**1 3 4**	**0 17 2**
4	Australorps—Dry mash, 10 per cent. meat meal	3	677	1,354	226	1,406	264	351	351	4,629	15 14 5	9,294	54 3 6	38 9 1
	Average	..	..	..	..	..	..	..	..	**92·6**	**0 6 3**	**185·9**	**1 1 8**	**0 15 5**
5	Australorps—Dry mash, 15 per cent. meat meal	5	591	1,183	312	1,406	264	351	351	4,458	15 7 3	9,640	56 10 9	41 3 6
	Average	..	..	..	..	..	..	..	..	**89·2**	**0 6 2**	**192·8**	**1 2 7**	**0 16 5**
6	White Leghorns—Dry mash, no meat meal	3	784	1,569	..	1,406	264	351	351	4,725	15 10 7	9,779	56 10 2	40 19 7
	Average	..	..	..	..	..	..	..	..	**94·5**	**0 6 3**	**195·6**	**1 2 7**	**0 16 4**
7	White Leghorns—Dry mash, 5 per cent. meat meal	3	705	1,410	111	1,406	264	351	351	4,598	15 7 4	10,052	58 2 1	42 14 9
	Average	..	..	..	..	..	..	..	..	**92·0**	**0 6 2**	**201·0**	**1 3 3**	**0 17 1**
8	White Leghorns—Dry mash, 7½ per cent. meat meal	3	688	1,376	166	1,406	264	351	351	4,602	15 10 1	9,993	57 10 0	41 19 11
	Average	..	..	..	..	..	..	..	..	**92·0**	**0 6 2**	**199·9**	**1 3 0**	**0 16 10**
9	White Leghorns—Dry mash, 10 per cent. meat meal	4	661	1,322	220	1,406	264	351	351	4,575	15 10 8	9,997	57 15 0	42 4 4
	Average	..	..	..	..	..	..	..	..	**91·5**	**0 6 3**	**199·9**	**1 3 1**	**0 16 10**
10	White Leghorns—Dry mash, 15 per cent. meat meal	4	610	1,220	323	1,406	264	351	351	4,525	15 12 0	10,353	59 16 8	44 4 8
	Average	..	..	..	..	..	..	..	..	**90·5**	**0 6 3**	**207·1**	**1 4 0**	**0 17 9**
	Total—500 birds	35	..	..	..	..	..	..	..	45,992	154 17 3	97,611	567 8 0	412 10 9
	Average	..	..		..	..	..	..	..	**92·0**	**0 6 2**	**195·2**	**1 2 8**	**0 16 6**

Notes.—Average price of eggs, 1s. 4¾d. per doz. Food cost per dozen eggs, 4·6 pence. Food consumed per egg laid, 7·5 oz. Food consumed per bird per day, 4 oz. Cost of food per bird per week, 1·4 pence.

mash made it more satisfying and the birds were able to maintain health and production with less food. The total cost of food was practically the same in all pens.

The birds were kept under close observation throughout the test, but there appeared to be very little difference in their health and general appearance in the different pens. The eggs were also examined to see if the high protein feeding would cause blood spots or any other faults, but no difference could be found in the quality of the eggs. During the present year, similar tests are being conducted using wet mash instead of dry mash.

As the Australorps and White Leghorns in this test were treated in the same way, a comparison between the two breeds is of interest. The amount of food consumed by each breed was practically the same. The accompanying table shows the average monthly production of each breed for the 12 months.

AVERAGE MONTHLY PRODUCTION OF 250 AUSTRALORPS AND 250 WHITE LEGHORNS.

Month.	Australorps	White Leghorns.
	Eggs per bird	Eggs per bird
April	15·1	14·3
May	16·2	16·0
June	15·7	14·7
July	16·4	14·2
August	17·7	17·0
September	19·7	21·4
October	19·7	22·0
November	16·1	20·1
December	16·2	19·4
January	13·2	17·2
February	12·3	14·5
March	11·3	9·8
Average per bird for 12 months	189·7	200·7

Fertilizers Act

Prosecutions for Offences

At the Sunshine Court of Petty Sessions before Mr. Pyvis and bench of honorary justices on the 9th June, 1939, Ellen Augusta Christina Pennell, Jessica Rita Pennell, and Albert George Pennell, trading as G. W. Pennell, Burke-street, Braybrook, were charged under sections 16 and 44 of the *Fertilizers Act* 1928, No. 3680. Evidence was given that a sample of ANA Surprise Animal Fertilizer which was withdrawn from a parcel of 30 bags at the defendant's factory on the 9th February, 1939, was found on analysis to have a percentage deficiency of 19.6 per cent. in the phosphoric acid content when compared with the percentage stated on the labels attached to the bags containing the fertilizer, and said percentage deficiency exceeded the limits allowed by section 16 of the Act, viz., 7 per cent.

The label attached to each of the bags of fertilizer guaranteed the fertilizer to contain:—

Nitrogen as blood, bone, and meat ..	5%
Phosphoric acid, citrate soluble	4%
Phosphoric acid, citrate insoluble ..	10%
Phosphoric acid, total	14%

It was proved that the analysis of the sample of fertilizer taken at the defendant's works gave the following figures:—

Nitrogen	6.28%
Phosphoric acid, water soluble ..	0.48%
Phosphoric acid, citrate soluble ..	3.52%
Phosphoric acid, citrate insoluble..	7.26%
Phosphoric acid, total	11.26%

The fertilizer contained chromium, which is associated with a certain hydrolized leather product.

Evidence showed that the high nitrogen figure was due in part to adulteration with hydrolized leather, that the hydrolized leather was foreign to ANA Surprise Animal Fertilizer, and that leather in any form contained appreciable quantities of the plant food nitrogen which however, was in an unavailable condition.

A prior convicition under section 16 was proved.

Defendants were convicted under section 44 in that they did sell a fertilizer in respect of which no brand was registered, and were fined £10.

Albert George Pennell was convicted under section 16 and fined £20 with £6 8s. 10d. costs.

A stay of proceedings for 14 days was granted.

Butter Production and Export

The following table shows:—

(*a*) Factory production of butter and cheese in Victoria for the period July, 1938, to April, 1939, compared with the corresponding period of 1937–38.

(*b*) Quantities and percentages of various grades of bulk butter examined in Victoria for export during the period July, 1938, to May, 1939, in comparison with the corresponding period of 1937-38.

FACTORY PRODUCTION OF BUTTER AND CHEESE IN VICTORIA (QUANTITIES IN TONS).

Month.	Butter.		Cheese.	
	1938–39.	1937–38.	1938–39.	1937–38.
July to February	40,625	49,182	6,893	5,696
March	3,717*	4,262	402*	506
April	4,016†	3,086	358†	456
Totals—10 Months	48,358	56,530	7,653	6,658

* Revised. † Subject to revision.

BULK BUTTER EXAMINED IN VICTORIA FOR EXPORT (QUANTITIES IN TONS).

Month.	1938-39. How Graded—				Total.	Month.	1937-38. How Graded—				Total
	Ch.	1st.	2nd.	Pty.			Ch.	1st.	2nd.	Pty.	
July to April ..	16,666	6,669	2,004	179	25,518	July to April ..	22,537	8,970	2,086	103	33,696
May	1,282	535	180	19	2,016	May	58	42	53	1	154
Totals—11 Months ..	17,948	7,204	2,184	198	27,534	Totals—11 Months	22,595	9,012	2,139	104	33,850
Percentages ..	65·2	26·2	7·9	0·7	..	Percentages ..	66·8	26·6	6·3	0·3	..

Wireless Talks for Farmers

WITH the co operation of the Australian Broadcasting Commission, the Victorian Department of Agriculture is conducting a series of wireless talks on subjects of particular interest to the man on the land. These talks are being broadcast from the regional stations, 2CO (Corowa), 3GI (Gippsland), and 3WV (Horsham) on Friday evenings, the 15-minute sessions commencing at 7.40 p.m.

The next talks will be on 14th July, 21st July and 18th August.

In order that these talks might be of maximum value to the farming community the Department is anxious to have the co-operation of listeners, who are invited to submit questions they would like answered over the air. If you have any particular problem connected with the management of your farm, your crops, or your live stock, or with the marketing of your produce, send a letter to Mr. J. Keane, B.Agr.Sc., Department of Agriculture, Melbourne. Your problem will then be submitted to expert officers of the Department, whose advice will be given. If you do not desire your name broadcast use initials or a nom-de-plume, but do not omit to mention your district.

By A. W. Jessep, M.Agr.Sc., B.Sc., Dip. Ed., Principal, School of Horticulture, Burnley.

Garden Notes.

JUST now the gardens are beginning to look very bare and dreary, but it will not be long before they begin again to show signs of life and colour, particularly if a good collection of flowering fruit trees are present; with a good selection of these it is possible to have blooms from July to October. The flowers are outstanding, and help greatly to relieve the bareness of late winter.

The Japanese plums are the first to flower, these are followed by the almonds, peaches, apples, and lastly the cherries. *Prunus mume* heads the list, usually bursting into bud at the end of June or beginning of July. Though it is known as the Japanese plum it is a distinct apricot, as may be seen from the fruit when it develops. These are single or double flowers varying in colour from white to dark pink, and all have a delightful perfume.

At the end of July and the beginning of August, the almond trees come into bloom. If only two or three are grown, they may be cut back while in flower, and the flowers used for decoration; in this way the necessity of pruning in the winter can be avoided.

Early August also sees the dark-leaved Japanese plums in flower; *Prunus nigra* and *Prunus blierand*. The latter is a beautiful double-flowered pink variety, and is probably the best of the flowering plums. From middle to late August the flowering almond, *Amygdalus pollardi*, comes into bloom. It was produced by Mr. Pollard, of Ballarat, and is a beautiful sight when in full bloom, having very large light pink flowers. *Prunus sinensis* and *Prunus tricolour* follow on in early September. These are the small, very free flowering plums. They grow to a height of about 4 feet; the flowers are double and there are both pink and white varieties.

When the plums and almonds have finished blooming, the crab apples and cherries commence. The apples are usually known under the name of Pyrus or Malus and some of the best varieties are included in the following:—

Pyrus floribunda and *Pyrus spectabilis* are two of the older and two of the best varieties They flower in September. Floribunda has rosy-pink single flowers, spectabilis has large clusters of double shell-pink bloom. One of the latest to bloom is *Pyrus angustifolia*; it produces clusters of very large double pink

A flowering plum.

flowers about the middle of October. *Pyrus gorgeous* is another very popular variety, mainly on account of its spectacular fruit.

The cherries flower in October, and although not nearly so hardy as the apples and plums, they are worth growing if a suitable situation is available. They should be pruned, if at all, after flowering. It is advisable to cut the plums and almonds back each year, as they flower on the first year wood, but the apples, like the cherries, should be cut very sparingly.

All these trees should be planted this month; also any other deciduous trees.

Pruning is one of the important jobs in the garden, at the moment. Roses, Hydrangea and other deciduous shrubs require to be pruned each year.

It is a busy time on the herbaceous border just now; perennials should be lifted, divided and transplanted as desired. Any additions to the herbaceous border should be made now. Amongst the hardiest of herbaceous perennials are perennial asters, cannas, delphiniums, lupins, perennial phlox, helenium, rudbekia and salvia. The ground around the seedlings must be kept well stirred.

After the rains now is an excellent chance to see where the ground is waterlogged, and in such places drainage should be attended to.

Vegetables.

August is the main month for sowing vegetable crops, and opportunity should now be taken to thoroughly prepare the ground. The area should be well dug and a liberal supply of farmyard manure worked into the soil, in order to give it time to rot down before the seedlings are transplanted.

At present, the limiting factor of growth is the cold weather, and to allow as much sunlight and air as possible into the soil, the hoe should be freely used and the soil kept loose. If the soil appears to be waterlogged, make provision for the excess water to be drained away. If the growth of the plants seems too slow, a light dressing of market garden manure, 1½ ounces to the square yard, should be lightly forked in between the plants.

Further plantings of broad beans can be made, and if the earlier plantings are showing signs of aphis, give them a good spraying of nicotine sulphate and soft soap.

The main crop of peas should be sown this month; at the present time Greenfeast seems to be the most popular variety. Selected Greenfeast seed when tested here gave better results under our particular conditions than did any of the other late sowings. This does not mean that it is the best under different conditions of soil, climate and time of sowing. When sowing peas, it has been found that the manure must not be placed alongside the seeds; otherwise germination is adversely affected. For home use, plant in rows about 2 feet apart with 2 inches between the seeds in the rows and about 1 inch deep. When the plants are well above the ground, give them a dressing of 1 part sulphate of potash to 2 parts superphosphate and water it in and draw the soil towards the plants so that they will be slightly hilled.

Small fruits require attention now. Cut out the old wood from raspberries, gooseberries, and currants and tie the loganberries back. Strawberries should be inspected, any weak ones removed and replaced by runners from the best plants in the patch. If the rhubarb and herbs have not already been divided and replanted, this work should be done as soon as possible.

Orchard Notes

By J. L. Provan, B.Agr.Sc., Senior Horticultural Instructor.

BY this time of the year, some of the pruning will have been completed and growers will be able to form a more accurate estimate of the blossom buds and potential crop for the coming season. The present indications are that the crops will be heavy, and growers should regulate the yield by various methods of pruning, reducing and thinning out a number of spurs and shortening laterals. A discussion of pruning practices in these notes cannot be satisfactorily undertaken, but there are many methods apart from those commonly adopted which should receive consideration. For instance, many orchardists when pruning are forced to remove limbs yet take no precautions to thoroughly protect the large cuts that have to be made. Broken limbs also should be neatly trimmed and care taken that no stubs, which will ultimately die, are left on the trees. Attention to these several points will reduce the incidence of Polystictus which is a fairly prevalent disease in our orchards. Trimming large wounds and painting with a good white-lead paint is a reliable insurance against infection. In the re-working of trees, any external dead wood should be neatly removed before infection takes place and the consequent wounds protected by painting.

Almost every orchardist is familiar with an odd limb or two dying back on his trees. There are many causes of this condition; Polystictus, root-borer and poor drainage are the chief; but whatever the cause, it should be removed as promptly as possible.

The prospects of good crops next year necessitate some thought on the application of artificial fertilizers. If the trees are to carry heavy crops of fruit of good commercial size, and the trees are not to be severely affected, feeding will be essential. Growers should remember that, as well as producing fruit this season, the trees must make growth and develop buds for the succeeding year. A very good mixture for general orchard work is the 2 : 2 : 1 complete manure which contains 2 parts sulphate of ammonia, 2 superphosphate, and 1 potash. The amount of each application will, of course, depend upon the size of the tree and the fertility of the soil. Where growth has been rather poor in the past, it may be necessary to apply 6 or 7 lb. of the mixture per tree, but if growth and cropping have been satisfactory, 4 or 5 lb. should be sufficient. For very large trees, and in poorer soil types, these applications may be increased. They should be given during August.

Limbs of a pear tree killed by San Jose scale.—Note new growth from base.

Orchard heating for varieties of fruit which bloom early, for example, almonds and apricots, should be considered by growers in frosty localities. Not only growers of early fruits, but also some apple-growers, find it best to protect their orchards by direct heating. Various forms of heating, such as wood-stacks, briquette and oil burners, have been employed; these are to be preferred to the smudge fire types which are only effective in very mild frosts, say, 2 or 3 degrees. If employed, they must commence early before the air temperature falls to freezing point. The effectiveness of a smudge fire is due to its providing a blanket of smoke

preventing the rapid and continuous loss of heat from the soil by radiation. The effect is the same as that produced on a large scale on cloudy nights when the presence of clouds lessens radiation and so prevents frost.

Towards the end of the month, early blossoming almond varieties commence blooming. One of the first is Brande's Jordan. Provision should be made for cross-pollination by placing flowering limbs of other varieties in the trees, re-working other varieties, which blossom at the same time, on one of the leaders of the trees, and by providing hives of bees for the transport of pollen from blossom to blossom.

For the control of the green peach aphid, tar distillate spray, 3 in 100, should be applied before the end of July. If applied later, damage to developing buds will result. To assist in the control of this insect, headlands and channel banks should be cleaned of weeds, which act as hosts, before spraying commences. The favorable growing conditions of last autumn, have provided ample food and cover for this aphid and indications are that it will be very troublesome this spring unless thorough and adequate control measures are adopted. The green peach aphid migrates from the weeds to lay its eggs on the peach tree, so that the tar distillate spray should be delayed as late as possible to destroy the eggs of the later migrating aphids.

A useful method of destroying weeds along headlands where cultivation is impracticable or along fences and head-ditches, is to use a flame-thrower burning fuel oil. If the burning is done in the autumn when there is a mixture of dry and green grass a very good burn will be obtained.

Growers who have already completed their tar distillate sprays should inspect their outside rows of trees to examine the eggs of the aphid and watch for later migration.

In the cooler apple-growing districts of the State where the woolly aphid continues to be troublesome in spite of the presence of the parasite *Aphelinus mali*, growers will find that better control can be obtained by applying a red oil spray 1 in 15. This parasite is not very active during the early spring in these districts, and therefore woolly aphid causes some damage before the parasite becomes effective.

Tubercle Free Herds

The following herds have been declared free of tuberculosis under the scheme conducted by the Department of Agriculture. Under this scheme a tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

ACCREDITED TUBERCLE FREE HERDS.

Herd Number.	Name.	Address.	Number in Herd.	Herd Number.	Name.	Address.	Number in Herd.
1	State Research Farm	Werribee ..	190	12	Black, Estate, Late I. S.	"The Cottage," Mount Noorat	44
2	Warragul High School	Warragul ..	35				
3	Payne, A. E. T. ..	"Yarra View," Lilydale	80	13	Read, John D. ..	"Springhurst Estate," Springhurst	99
4	Dennis, Mrs. A. A. ..	Frankston ..	14				
5	Reid, Ralph G. ..	"Holmwood," Koo-wee-rup	99	14	Kelly, C. ..	"Glenmore," Creighton's Creek, Euroa	22
6	Harris, J. W. ..	"Rowena," Clyde	72				
7	School of Horticulture	Burnley ..	8	15	Gorman, A. W. ..	"Cathcart." Alexandra	64
8	Lawrence, P. H. ..	"Rainga," Tarrawarra	59	16	Samuel, B. T. ..	Lang Lang ..	72
				17	Powell T. S. ..	"Carellen," Mansfield	48
9	Banyule Stud Pty. Ltd.	Heidelberg ..	54	18	Dunbar & Clark, Messrs.	"Hazeldean Dairy" Mount Dandenong	16
10	McIntosh, John ..	"Burnwood," Merrigum	31				
11	Black, Mrs. Agnes ..	Mount Noorat	40				

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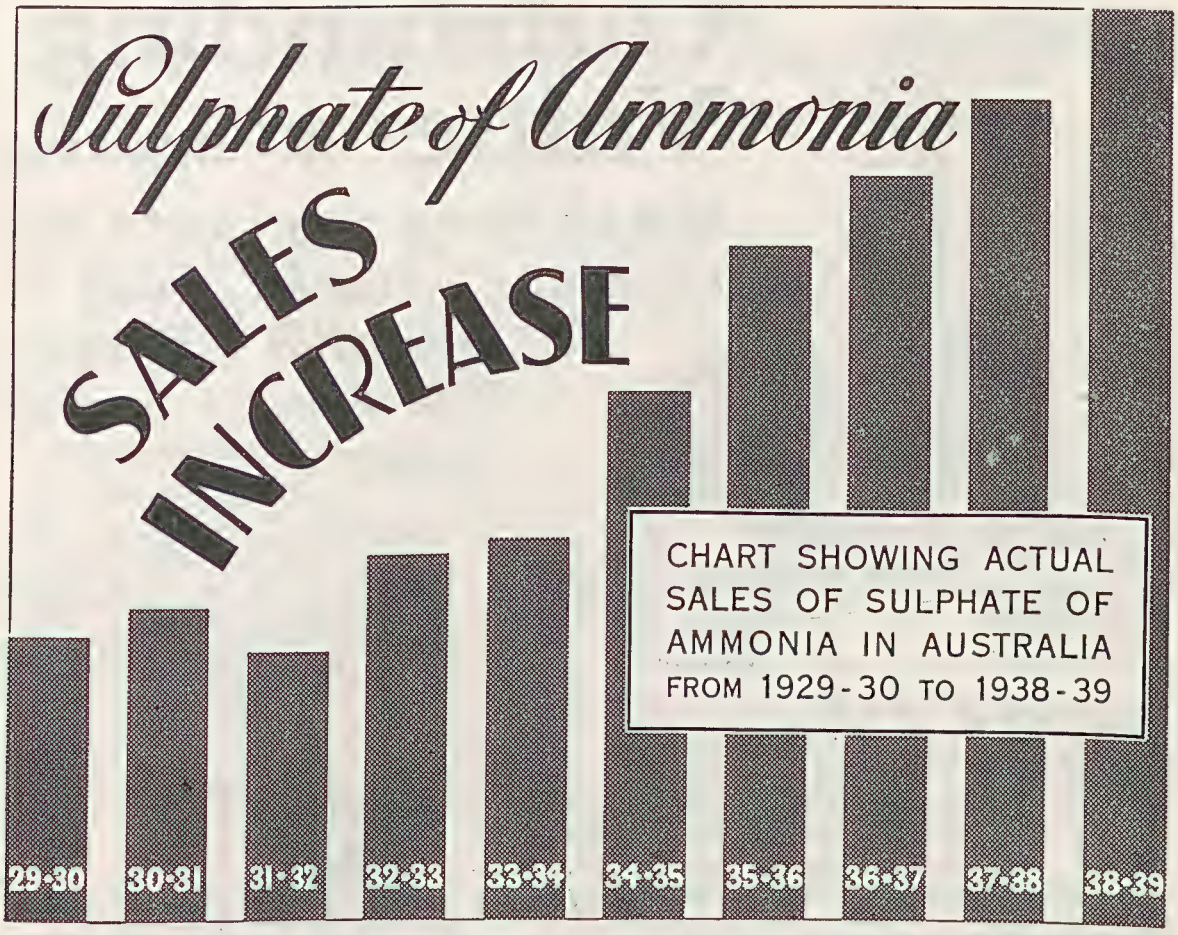

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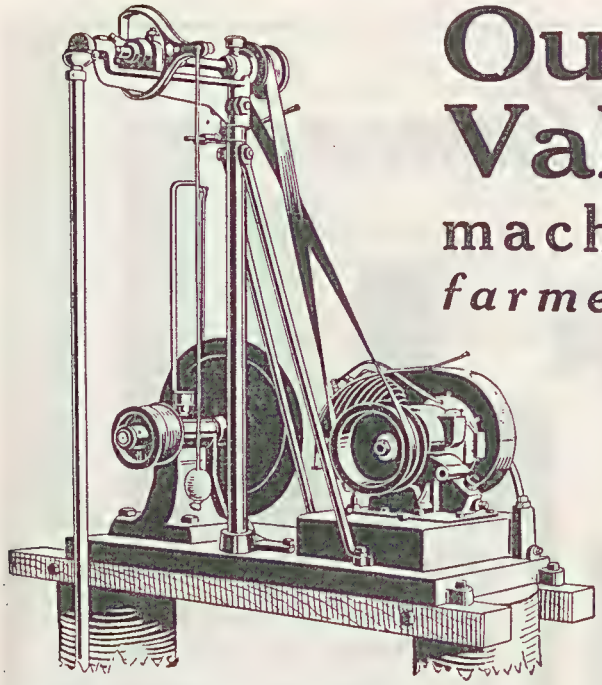

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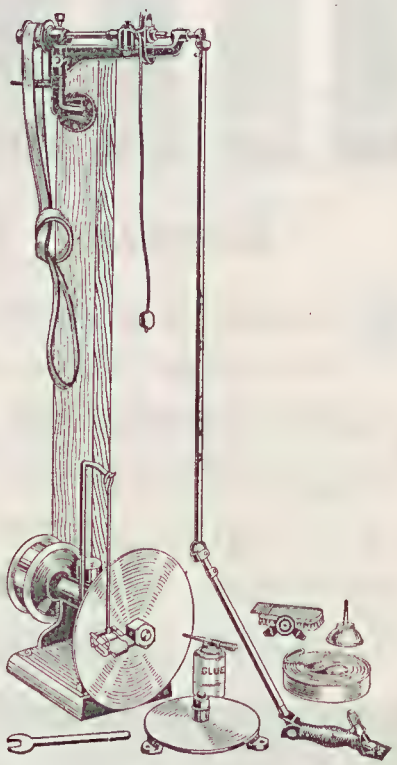

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Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

The Influence of Nutrition on the Reaction of Wheat to Urocystis Tritici Koern—Part II.

By C. R. Millikan, M.Agr.Sc., Plant Pathologist

Field Mineral Treatment Tests.

TO date little information is available as to the effect of soil treatment on the reaction of wheat to *Urocystis tritici*. Observations indicating the probable influence of manurial treatment on the development of flag smut have been made by Forster and Vasey (10). A relation was found to exist between the application of lime and stable manure and the severity of the disease. Frequent applications of lime increased the alkalinity of the soil from pH 5·5 to a maximum of pH 8·3 and the plots so limed showed the highest infection with flag smut. A possible relation was indicated between the changes in the soil pH and the incidence of the disease.

In 1933, experiments were initiated to determine the effect of mineral treatment under field conditions, on the reaction of wheat to flag smut, and to determine the nature of the factors concerned in the variations in resistance. It was hoped that by applications of various minerals, changes in the mineral composition of the plant could be induced, and that these changes could be correlated with the variations in the plant's resistance to the disease as manifested by the production of sori.

Portion of flag smut field experiments, Walpeup.

The results obtained in the 1933 experiments at the Experiment Station, Rutherglen, and the Mallee Research Station, Walpeup, have been reported (20), but no attempt was made in that report to establish a relationship between any change in the mineral composition of the plants and their flag smut reaction. It is the purpose of this report to interpret the results of the 1933 and subsequent field experiments which were designed to be complementary to the sand culture experiments conducted at Burnley.

Method.

Hand sown rows were used for these tests (Fig. 3). Each row was 60 links long and was sown with seed of the susceptible variety Free Gallipoli inoculated with 1 per cent. flag smut spores. In 1938, a small experiment was also sown with inoculated seed of the resistant variety Ghurka.

The distance between rows was 3 links. At sowing time, each row was opened up to a uniform depth of 3 inches, and 150 grains were evenly spaced along the furrow. A weighed amount of the appropriate mineral, diluted with soil to ensure even distribution, was then applied to the row. After treatment the furrow was filled in and the surface levelled off with a garden rake to ensure an even depth for the seed. Each treatment was replicated six times, except in the 1933 experiments, when the number of replications was three.

The trials were sown early in the season each year, as experience had shown that this practice was favorable to a high smut infection. The date of germination of the rows was recorded and samples of plants for mineral analyses were taken at six and nine weeks after this date. This period may be regarded as critical for the development of the flag smut fungus in the plant, as experience has shown that under Victorian field conditions sori consistently appear at approximately eleven weeks after germination.

Table V.—Results of Flag Smut Manurial Treatment Experiments at Rutherglen and Walpeup, 1933, Showing the Analyses of Plants at Six and Nine Weeks after Germination as Percentage on Dry Basis, and the Percentage Flag Smut Developing in the Remaining Plants (After Miller and Millikan).

Treatment.	Rutherglen.					Walpeup.				
	Untreated.	Superphosphate, 1½ cwt. p.a.	Lime, 1 ton p.a.	Sulphate of Ammonia, 1½ cwt. p.a.	Sulphuric Acid.	Untreated.	Superphosphate, 1½ cwt. p.a.	Lime, 1 ton p.a.	Sulphate of Ammonia, 1½ cwt. p.a.	Sulphuric Acid.
(a) First Sampling—Six Weeks after Germination.										
Nitrogen	4·40	5·51	4·55	4·34	5·22	5·00	5·32	5·05	5·46	4·95
Total Ash ..	13·72	16·96	14·24	13·67	16·02	22·86	22·99	21·90	20·45	20·89
Silica (SiO_2) ..	4·81	5·21	4·73	5·58	6·03	10·85	9·79	9·61	7·98	8·73
Silica-free Ash ..	8·91	11·75	9·51	8·09	9·99	12·01	13·20	12·29	12·47	12·16
Lime (CaO) ..	0·50	0·54	0·56	0·45	0·55	0·73	0·77	0·73	0·80	0·75
Potash (K_2O) ..	4·31	6·01	4·67	3·83	4·98	5·34	5·91	5·67	5·49	5·56
Phosphoric Acid (P_2O_5)	0·71	1·47	0·68	0·60	0·88	1·12	1·56	1·22	1·14	1·09
(b) Second Sampling—Nine Weeks after Germination.										
Nitrogen	4·36	4·47	4·36	4·97	3·99	4·78	5·44	5·11	4·88	4·73
Total Ash ..	17·64	23·14	22·84	19·00	27·92	19·52	18·86	16·13	17·46	17·31
Silica (SiO_2) ..	8·93	13·40	13·91	9·44	19·68	8·53	6·61	4·78	6·13	6·23
Silica-free Ash ..	8·71	9·74	8·93	9·56	8·24	10·99	12·25	11·35	11·33	11·08
Lime (CaO) ..	0·42	0·35	0·42	0·29	0·28	0·56	0·51	0·59	0·68	0·58
Potash (K_2O) ..	4·24	4·99	4·33	4·94	4·09	4·91	5·79	5·29	5·27	5·20
Phosphoric Acid (P_2O_5)	0·77	0·99	0·85	0·93	0·75	0·85	1·31	0·88	0·80	0·86
Flag Smut Infection: Per cent.	83·4	62·4	81·6	73·6	33·2	72·9	72·3	65·5	43·9	70·5
Standard Error	5·3%					2·3%				

Each plant sample for any treatment consisted of a composite of the same number of plants taken at random from each replicate of that treatment. The roots of the plants were excluded from the samples. The number of plants per composite sample was 150 at six weeks, and 100 at nine weeks. The samples were forwarded to the Agricultural Research Chemist at The State Laboratories, where the ash and other analyses were performed.

At the end of the season, the amount of smut developing in the remaining plants in each row was recorded. With the exception of the 1933 and 1934 experiments the number of totally infected plants (producing no ears), partially infected plants (producing one to several ears), and apparently healthy plants, were recorded separately. The percentage of infected plants was obtained from the sum of the totally and partially infected plants. During the progress of the counts, however, it became obvious that in rows receiving certain treatments, the proportion of totally infected, to partially infected plants (i.e., the severity of the symptoms) was much reduced even though the percentage infection remained high. Percentage infection alone, which takes no account of the severity of symptoms in the individual plants, proved therefore to be an inadequate basis on which to determine the relative effects of the various mineral treatments on the development of flag smut.

An index of the severity of flag smut infection in any particular row, which made allowance for the severity of symptoms as well as the number of plants infected was obtained as under:

Each plant in the row was allotted points in accordance with the following schedule:—

Totally infected plants	.. Two points.
Partially infected plants	.. One point.
Apparently healthy plants	Nil.

The severity index was then obtained from the following expression:—

$$\text{Severity Index} = \frac{\text{Total Number of Points Scored}}{(\text{Number of plants in the row}) \times 2} \times \frac{100}{1}$$

As the totally infected plants are usually those in which flag smut symptoms appear first, the severity index obtained by the above method provided a much more complete picture of the relative resistance variations induced by the various mineral treatments at 6 and 9 weeks, than did percentage infection.

A statistical examination of the results was made in accordance with the analysis of variance methods (6, 29).

Results.

The results of the field experiments conducted during the period 1933 to 1938 are set out hereunder. The experiments were principally sown at the Mallee Research Station, Walpeup, although in 1934 and 1938, small trials were conducted at other centres as indicated below.

Details of the results from each experiment are first given, and conclusions are then drawn based on a consideration of the results as a whole.

1933.—As indicated above, the results of the 1933 trials have been published previously (20), but they are repeated in this report (Table V.) for convenience.

1934.—During 1934, further information was obtained as to the effect of manurial treatment on the development of flag smut in various districts of Victoria as indicated in Table VI. No plants from the 1934 trials were chemically analysed to determine the effect of the treatments on their mineral constituents, so that the value of these experiments is somewhat limited. Significant differences in percentage infection resulted from the application of certain of the treatments, notably superphosphate and sulphate of ammonia.

It is to be noted, however, that the relative effects of the treatments on the development of the disease, were not constant at each centre.

1936.—The experiment in 1936 was sown at the Mallee Research Station. Four treatments were included namely:—

Untreated; Superphosphate, 3 cwt per acre; Sulphate of Ammonia, 3 cwt. per acre; and Potassium permanganate, 40 lb. per acre.

The rows were sampled only at nine weeks after germination for chemical analyses, but two composite samples of plants were obtained for each treatment at that time, one from replicates 1 to 3 and the other from replicates 4 to 6. Separate analyses were performed on each of these samples. The average results of these analyses are shown in Table VII.

All three treatments resulted in a significant decrease in the flag smut severity index when compared with the untreated controls, the greatest decrease resulting from a dressing of sulphate of ammonia.

1937.—The number of treatments included in the experiment was increased in 1937 to include certain mineral compounds.

The details of the treatments were as follows :—

Untreated ; Superphosphate, 3 cwt per acre ; Ammonium sulphate, 3 cwt. per acre ; Zinc Sulphate, 40 lb. per acre ; Magnesium sulphate, 40 lb. ; Potassium sulphate, 1 cwt. per acre ; Calcium sulphate, 3 cwt. per acre ; and Ferrous sulphate, 40 lb. per acre.

Plant samples were obtained from the rows at both six and nine weeks after germination. The six weeks samples were analysed only for silica, silica free ash, lime (CaO) and magnesia (MgO), but, as indicated in Table VIII. a much more complete analysis was performed on the nine weeks old plants.

Sulphate of ammonia, in this experiment produced a very large and significant reduction in the amount of flag smut infection. On the other hand, a dressing of potash at the rate of 1 cwt. per acre caused a significant increase in the amount of smut present. It is of interest to compare this result with that obtained in 1934 (Table VI.) at Walpeup, where a heavier dressing of this material produced a significant decrease in the percentage infection when compared with the controls.

The value of the severity index figure as a means of expressing the amount of flag smut developing is illustrated by the disease figures given for the superphosphate treatment in Table VIII. Whereas there was a barely significant increase in the percentage infection, the flag smut severity index due to a dressing of superphosphate was significantly reduced. This was due to the fact that the proportion of partially infected to totally infected plants was much higher in the rows receiving this treatment than in the control rows.

TABLE VI.—FLAG SMUT MANURIAL EXPERIMENTS, 1934, SHOWING THE AVERAGE PERCENTAGE INFECTION RESULTING FROM THE DIFFERENT MANURIAL TREATMENTS.

Treatment.	Walpeup (Mallee).	Longerenong (Wimmera).	Dookie (Northern)	Rutherglen (North-Eastern).
	%	%	%	%
Untreated	69·6	43·2	46·0	28·0
Superphosphate, 1½ cwt p.a.	46·3	34·8	21·9	21·7
Ammonium sulphate, 1½ cwt. p.a.	35·0	6·4	42·3	21·8
Lime, 20 cwt./ac.	49·7	28·8	33·5	17·6
Potash, 3 cwt. p.a.	54·5	45·4	..	28·8
Gypsum, 10 cwt. p.a.	..	51·5	..	28·7
Superphosphate + Ammonium Sulphate	45·5	..	..	..
Superphosphate + lime	51·0	..	..	..
Farm-yard manure	..	..	30·0	..
Standard Error	4·2	2·3	3·9	3·6

TABLE VII.—RESULTS OF FLAG SMUT MANURIAL TREATMENT EXPERIMENT, WALPEUP, 1936, SHOWING THE ANALYSES, AS PERCENTAGE ON DRY BASIS, OF PLANTS NINE WEEKS AFTER GERMINATION, AND THE PERCENTAGE AND SEVERITY INDEX OF THE RESULTANT FLAG SMUT INFECTION.

—		Untreated.	Superphosphate, 3 cwt./ac.	Sulphate of Ammonia, 3 cwt./ac.	Potassium Permanganate, 40 lb./ac.	Standard Error.
Total Ash		16·52	17·62	16·80	17·13	..
Silica (SiO_2)		5·43	5·49	5·14	5·69	..
Silica Free Ash		11·09	12·13	11·66	11·43	..
Lime (CaO)		0·28	0·23	0·37	0·26	..
Magnesia (MgO)		0·36	0·36	0·29	0·34	..
Phosphoric Acid (P_2O_5)		0·86	1·27	0·79	0·88	..
Potash (K_2O)		5·77	6·21	6·08	5·95	..
Manganese (Mn)		0·012	0·014	0·011	0·016	..
Nitrogen		4·36	4·49	5·00	4·37	..
Flag Smut	Percentage Infection	76·5	68·1	56·6	68·5	3·28
	Severity Index	55·6	42·5	33·5	44·9	3·65

1938.—The experiment at the Mallee Research Station was continued in 1938, and, in addition, a small test was sown at the State Experiment Farm, Rutherglen. As in previous years a trial was sown using the susceptible variety Free Gallipoli, but in this year a further trial sown with the resistant Ghurka variety was included at Walpeup.

When sown, the Free Gallipoli experiment contained twelve treatments as under:—

Untreated; Superphosphate, 3 cwt. per acre; Ammonium sulphate, 3 cwt. per acre; Sodium nitrate, 4 cwt. per acre; Potassium sulphate, 1 cwt. per acre; Potassium sulphate, 10 cwt. per acre; Calcium nitrate, 3 cwt. per acre; Calcium sulphate, 3 cwt. per acre; Super, 3 cwt. + Potassium sulphate, 1 cwt. per acre; Super, 3 cwt. + Calcium nitrate, 3 cwt. per acre; Super, 3 cwt. + Borax, 15 lb. per acre; and Super, 3 cwt. + Ammonium sulphate, 3 cwt. per acre.

It was originally intended that analyses should be made on plant samples taken from each of these treatments at both six and nine weeks after germination. Unfortunately, however, the 1938 season was extremely dry (only 2½ inches of rain fell during the growing period) so that the germination and growth of certain of the rows was adversely affected both by the seasonal conditions and the mineral treatment. For this reason the following treatments were excluded from the experiment: Sodium nitrate, 4 cwt. per acre, Super + Calcium nitrate, Super + Borax, Super + Ammonium sulphate and Potassium sulphate, 10 cwt.

Insufficient plants occurred in the ammonium sulphate, 3 cwt. and calcium nitrate, 3 cwt. treatments to enable samples to be taken at both six and nine weeks after germination, so that only one sample at nine weeks was obtained. The remaining treatments were sampled at both periods.

As the previous work had strongly indicated a relation between the calcium content of the plant and its flag smut reaction, this was the only mineral constituent determined. In addition an analysis for ammoniacal nitrogen was made

TABLE VIII.—RESULTS OF FLAG SMUT MINERAL TREATMENT EXPERIMENT, WALPEUP, 1937, SHOWING THE ANALYSES, AS PERCENTAGE ON DRY BASIS, OF PLANTS AT SIX AND NINE WEEKS AFTER GERMINATION, AND THE PERCENTAGE AND SEVERITY INDEX OF THE RESULTANT FLAG SMUT INFECTION. VARIETY FREE GALLIPOLI.

	Untreated.	Superphosphate, 3 cwt./ac.	Sulphate of Ammonia, 3 cwt./ac.	Zinc Sulphate, 40 lb./ac.	Magnesium Sulphate, 40 lb.	Potassium Sulphate, 1 cwt./ac.	Calcium Sulphate, 3 cwt./ac.	Ferrous Sulphate, 40 lb./ac.	Standard Error.
(a) First Sampling—Six Weeks after Germination.									
Total Ash	17·90	19·77	16·80	18·62	18·89	16·88	19·16	16·45	..
Silica (SiO_2)	6·53	7·14	5·40	7·69	6·23	5·92	7·73	5·62	..
Silica Free Ash	11·37	12·63	11·40	10·93	12·66	10·96	11·43	10·83	..
Lime (CaO)	0·57	0·50	0·70	0·62	0·60	0·54	0·58	0·56	..
Magnesia (MgO)	0·38	0·41	0·35	0·39	0·42	0·36	0·38	0·39	..
(b) Second Sampling—Nine Weeks after Germination.									
Nitrogen	3·87	5·55	4·63	4·04	4·19	3·92	4·57	4·80	..
Total Ash	16·04	16·77	23·57	27·32	29·89	27·53	23·62	21·79	..
Silica (SiO_2)	6·31	4·95	12·44	18·10	20·82	18·17	13·82	12·15	..
Silica Free Ash	9·73	11·82	11·13	9·22	9·07	9·34	9·80	9·64	..
Phosphoric Acid (P_2O_5)	0·72	1·11	0·66	0·60	0·62	0·64	0·64	0·65	..
Potash (K_2O)	5·30	6·36	5·59	4·34	4·32	4·42	4·72	4·76	..
Lime (CaO)	0·40	0·40	0·60	0·39	0·53	0·50	0·60	0·50	..
Magnesia (MgO)	0·20	0·32	0·24	0·21	0·48	0·44	0·49	0·47	..
Iron (Fe)	0·072	0·059	..	..	..	..	..	0·202	..
Zinc (Zn) parts per million	11	11	..	15	..	..	..	..	..
Flag Smut — Percentage Infection	70·3	74·2	12·9	71·1	70·7	82·2	74·5	73·0	1·51
Flag Smut — Severity Index	62·9	56·7	9·9	62·8	63·2	75·7	67·1	64·8	1·72

TABLE IX.—RESULTS OF FLAG SMUT MINERAL TREATMENT EXPERIMENT, WALPEUP, 1938, SHOWING THE ANALYSES, AS PERCENTAGE ON DRY BASIS OF PLANTS AT SIX AND NINE WEEKS AFTER GERMINATION, AND THE PERCENTAGE AND SEVERITY INDEX OF THE RESULTANT FLAG SMUT INFECTION. VARIETY, FREE GALLIPOLI.

		Untreated.	Superphosphate, 3 cwt. p.a.	Ammonium Sulphate, 3 cwt. p.a.	Potassium Sulphate, 1 cwt. p.a.	Calcium Nitrate, 3 cwt. p.a.	Calcium Sulphate, 3 cwt. p.a.	Super + Pot. Sulphate, 3 cwt. p.a.	Standard Error.
(a) First Sampling—Six Weeks after Germination.									
Ammoniacal Nitrogen		0·062	0·081	..	0·072	..	0·060	0·067	..
Total Ash		15·68	15·56	..	14·90	..	15·21	15·87	..
Silica (SiO_2)		4·92	3·30	..	3·71	..	4·18	3·59	..
Silica Free Ash		10·76	12·26	..	11·19	..	11·03	12·28	..
Lime (CaO)		0·71	0·67	..	0·69	..	0·78	0·62	..
(b) Second Sampling—Nine Weeks after Germination.									
Ammoniacal Nitrogen		0·069	0·072	0·070	0·059	0·095	0·089	0·081	..
Total Ash		15·20	16·62	15·96	15·83	17·88	15·40	15·60	..
Silica (SiO_2)		4·38	4·37	4·50	4·43	5·14	4·19	3·49	..
Silica Free Ash		10·82	12·25	11·46	11·40	12·74	11·21	12·11	..
Lime (CaO)		0·46	0·43	0·60	0·50	0·63	0·51	0·43	..
Flag Smut	Percentage Infection	71·7	47·9	29·8	67·9	14·2	66·9	43·9	2·8
	Severity Index	48·5	24·8	14·6	45·5	7·9	43·3	24·5	1·91

(Table IX.). As indicated above, a relation has been suggested between rust (*Puccinia* sp.) immunity in wheat and the plant's ammonia content, this latter being an hereditary varietal character, modified by environmental conditions (31).

Variations in the amount of flag smut which developed were again induced in this experiment as a result of the mineral treatments. The effect of superphosphate and sulphate of ammonia was similar to that produced in previous years. It is interesting to note the widely different effects on the disease produced by calcium nitrate and calcium sulphate. The former caused a very marked reduction in the severity index, while the variation produced by the latter was not significant. A considerable difference in the calcium contents of the plants also occurred between these two treatments.

Scatter diagrams have indicated that no apparent relationship exists between the ammoniacal nitrogen content of the plant at either six or nine weeks after germination and the amount of flag smut which subsequently develops.

The experiment with the resistant Ghurka variety was sown at Walpeup in 1938 as a complementary test to the Burnley sand culture tests, to determine if the resistance of this variety could be altered under field conditions by mineral treatment. The Burnley results recorded above have shown that excess calcium in the nutrient solution caused a significant increase in the percentage of plants of this variety which manifested flag smut sori. Four treatments only were included in the Walpeup trial as indicated in Table X.

TABLE X.—RESULTS OF FLAG SMUT MINERAL TREATMENT EXPERIMENT, WALPEUP, 1938, WITH THE RESISTANT VARIETY GHURKA, SHOWING THE PERCENTAGE INFECTION AND SEVERITY INDEX RESULTING FROM EACH TREATMENT.

Treatment.	Percentage Infection.	Severity Index.
Untreated	6·9	3·6
Potassium sulphate, 1 cwt. p.a.	6·3	3·3
Calcium sulphate, 3 cwt. p.a.	1·6	0·9
Calcium nitrate, 3 cwt. p.a.	1·9	0·9
Standard Error	0·92	0·57

No analyses of plants from this experiment were made. The calcium nitrate treatment had

a severe effect on the germination and early growth of the plants, probably owing to the drought conditions experienced during the season.

It will be seen from Table X. that significant decreases in the flag smut which developed, resulted from applications of calcium sulphate and calcium nitrate respectively. While the effect of the latter is similar to that recorded in the susceptible variety experiment Table IX. the calcium sulphate dressing in that experiment had no significant effect on the flag smut reaction of the susceptible variety. It would appear therefore, that the degree of flag smut resistance possessed by a wheat variety determines whether certain soil mineral treatments will affect its flag smut reaction.

In the experiment at the State Experiment Farm, Rutherglen, in 1938, four treatments were included. No analysis of plants from these rows were made. The results of the infection counts are shown in Table XI.

TABLE XI.—FLAG SMUT MINERAL TREATMENT EXPERIMENT, RUTHERGLEN, 1938, SHOWING THE PERCENTAGE INFECTION AND SEVERITY INDEX RESULTING FROM EACH TREATMENT.

Treatment.	Percentage Infection.	Severity Index.
Untreated	43·8	24·0
Superphosphate, 3 cwt. p.a. ..	23·1	11·8
Ammonium sulphate, 3 cwt. p.a.	25·5	14·4
Calcium nitrate, 3 cwt. p.a. ..	32·1	17·6
Standard Error	4·28	2·26

The effects of superphosphate and sulphate of ammonia on the disease were similar to those recorded in 1933 and 1934 (Tables V. and VI.) at this centre.

From a comparison of the effects of the calcium nitrate treatment in this experiment and at Walpeup in 1938 (Table IX.), it is seen that, whereas at Walpeup this treatment was associated with a very large and significant reduction in flag smut, the reduction at Rutherglen was barely significant. As indicated later this difference in the effect of calcium nitrate at the two centres is probably related to the very much lower natural calcium content of plants grown at Rutherglen as compared with those grown at Walpeup (Table V.). The Walpeup soil contains a large proportion of limestone which is absent from the Rutherglen soil.

From the results of the field experiments recorded above, it is evident that the flag smut

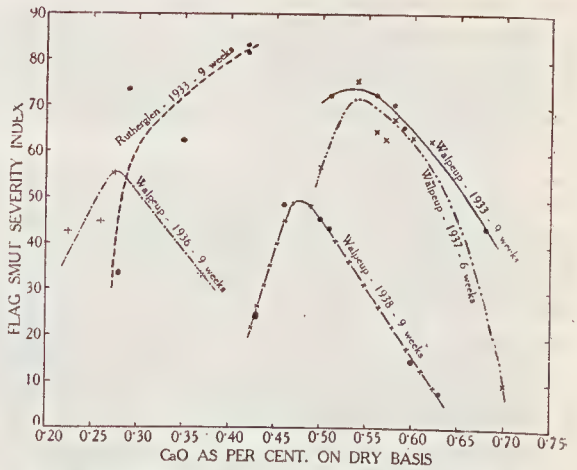
FLAG SMUT SEVERITY INDEX
CaO AS PER CENT. ON DRY BASIS
Rutherglen - 1933 - 9 weeks
Walpeup - 1936 - 9 weeks
Walpeup - 1933 - 9 weeks
Walpeup - 1937 - 6 weeks
Walpeup - 1938 - 9 weeks

Fig. 4.—Showing the relation between the calcium content of the plant at six or nine weeks after germination and the severity index of the resultant flag smut infection.—Note: The flag smut in the 1933 tests is expressed as percentage infection.

reaction of wheat can be materially altered by manurial or mineral treatment, and that the relative effects of such treatments are related to the differences which occur between the soils in the various districts in which the experiments were conducted. In addition it will be seen that large variations in the mineral composition of the plants were induced by the different mineral treatments. Scatter diagrams of the relation between these changes in the flag smut reaction of the plant and its mineral composition at six or nine weeks after germination, were made. Each individual constituent analysed in the different experiments was examined separately. Only in the case of the lime (CaO) content of the plant could any relationship be demonstrated.

This relationship is shown in Fig. 4, and indicates that under the conditions of any particular experiment the variations in the calcium concentration in the plants produced by the different treatments was such that at nine weeks after germination (six weeks in one instance), an optimum concentration occurred, and that irrespective of the treatment applied, if its effect on the calcium concentration in the plant was to increase it above, or decrease it below this point the amount of flag smut which developed was decreased.

This optimum concentration was not the same in all the experiments, indicating that its actual value is dependent on the conditions under which the plants are grown. Soil variations apparently affect the plants' normal calcium requirements

and hence the optimum concentration. This is indicated in Fig. 4 by the fact that the 1933 and 1937 experiments at Walpeup, which were sown in the same area, show the same optimum calcium concentration. The other experiments at Walpeup were sown on different areas.

As the optimum developed at nine weeks after germination (with the exception of the 1937 experiment), it is evident that this period is the most critical for the development of the disease. This is made more probable by the fact that under field conditions in Victoria, flag smut sori consistently first appear at approximately eleven weeks after the germination of the plants.

During this period the calcium concentration in the plant varies considerably being higher at six weeks than at nine weeks. In addition, the chemical analyses recorded above indicate that the relative effect of a treatment on the plant's calcium concentration may not be constant (i.e., there may be an increase in the percentage of lime (CaO) at six weeks compared with the controls, followed by a decrease at nine weeks).

The decrease in the lime concentration of the plant with age recorded above is in accord with the results of Knowles and Watkin (28), who found that the wheat plant in the early stages of its growth contains a high proportion of the maximum quantity of nitrogen, potash, lime, and chlorine which it eventually absorbs.

The relation of the calcium content of the plant to its flag smut reaction under field conditions confirms the results obtained from the sand culture experiments at Burnley. This relationship is very probably concerned in the varying effects on flag smut reaction induced by the same mineral when applied in different districts; by different rates of application of the same compound in the same district; or by different salts of the same base.

Applications of lime at Werribee (soil reaction pH 5·5) have been found to increase flag smut infection (14); at Rutherglen (pH 7·7) no change resulted in 1933 (Table V.), and a barely significant decrease was produced in 1934 (Table VI.), while at Walpeup (pH 8·6) significant decreases in infection have been obtained both in 1933 and 1934 (Tables V. and VI.). The most severe flag smut damage occurs in the Mallee district of Victoria, in which Walpeup is situated, where the soil contains a high percentage of limestone.

Potash at the rate of 1 cwt. per acre significantly increased the flag smut infection at Walpeup in 1937 (Table VIII.) and induced no change in 1938 (Table IX.), whereas a dressing of 3 cwt. per acre in 1934 significantly decreased infection (Table VI.). The effect of potash applications on the calcium concentration of the plant is to cause a slight decrease at six weeks, followed by an increase at nine weeks, compared with the untreated plants. No analyses of plants from the 1934 experiment are available, but it is presumed that the heavier dressing of potash would produce a marked variation in the calcium concentration rendering it less favorable to the development of the disease. Light and heavy dressings of potash were included in the 1938 experiments to investigate this point, but unfortunately the heavy dressing, combined with the drought conditions experienced in that season, produced a very deleterious effect on the growth of the plants so that this treatment had to be discarded. It is hoped in future experiments to obtain further information on the relation of the lime concentration of the plants to the opposite effects on the disease produced by light and heavy dressings of potash.

Calcium sulphate, 3 cwt. per acre produced no significant effect on flag smut infection at Walpeup in 1937 and 1938 (Tables VIII. and IX), whereas calcium nitrate at the same rate in 1938 produced a very large and significant decrease in the severity of the disease (Table IX.). The effect of this compound at Rutherglen in 1938 was very much less marked, as the reduction in the amount of disease which it induced was barely significant (Table XI.). The different effects of calcium nitrate and calcium sulphate on the disease at Walpeup are related to their different effects on the calcium concentration in the plant, which in turn are related to the differences in their solubilities. Both treatments increased the calcium concentration, but the increase was much greater in the calcium nitrate treated plants. Ammonium sulphate at Walpeup has a similar effect to calcium nitrate in greatly increasing the calcium concentration of the plant above the optimum point, and at the same time, markedly reducing the severity of the disease.

A small increase in the calcium concentration in the resistant Ghurka variety probably affects the development of the fungus within it to a greater degree than a similar increase in the susceptible variety Free Gallipoli. This is suggested by the significant reduction in the flag smut severity in Ghurka resulting from the application of calcium sulphate at Walpeup in 1938 (Table X.), whereas this material had produced no such effect on the disease in Free Gallipoli.

The concluding section of this paper, which deals with the Symptons and Effects of Unbalanced Nutrition in the Wheat Plant, will appear in a subsequent issue of this Journal.

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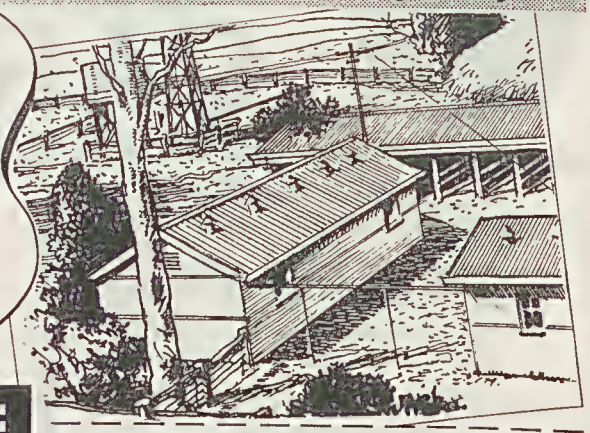

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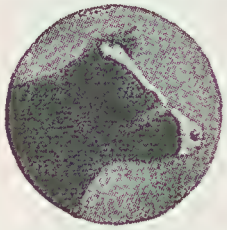

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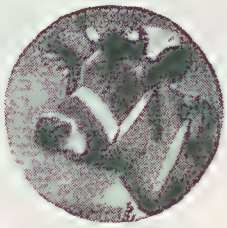

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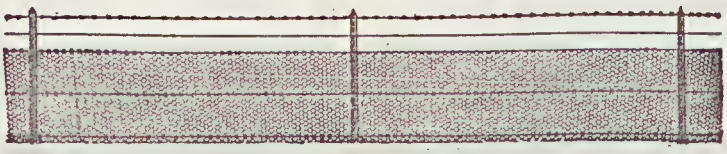

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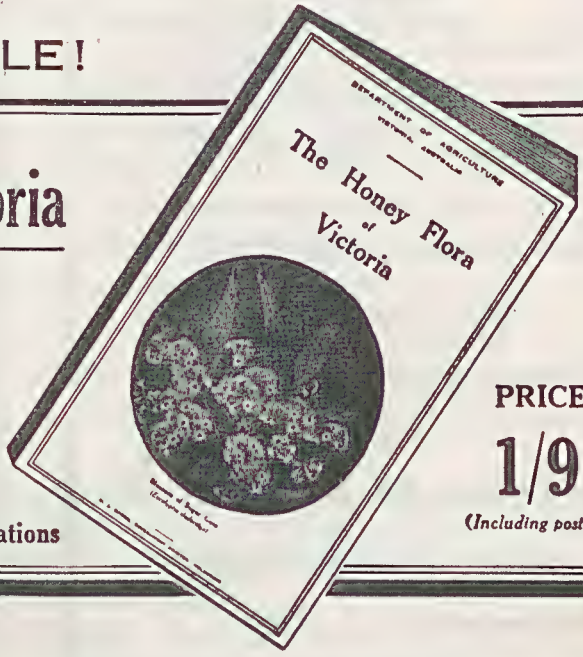

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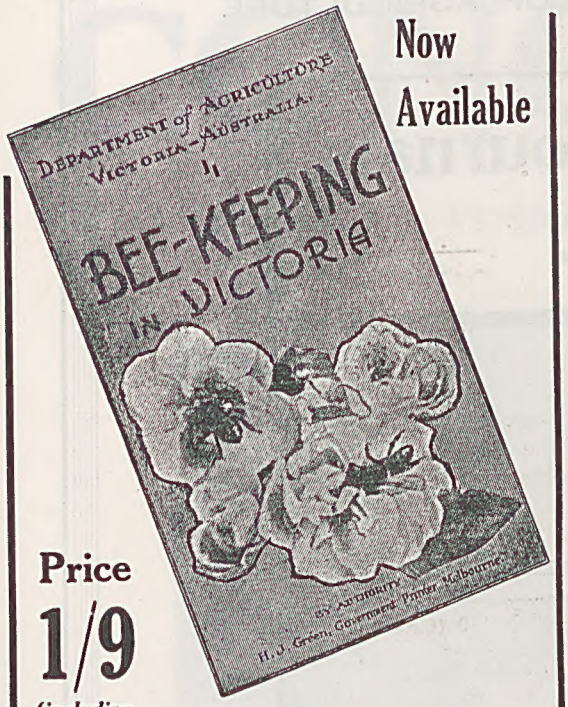

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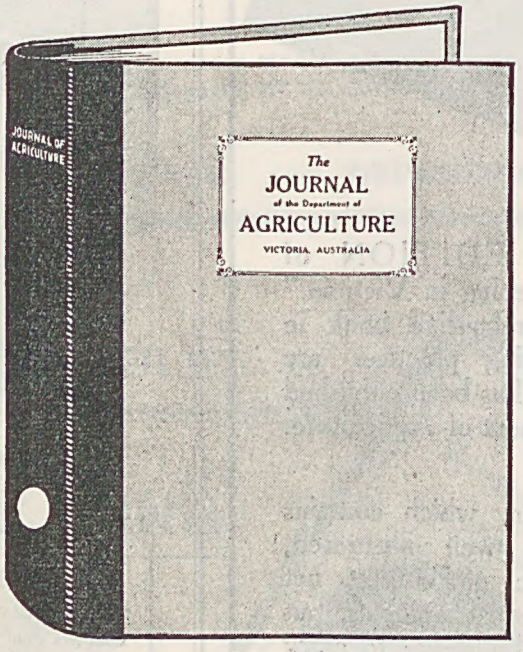

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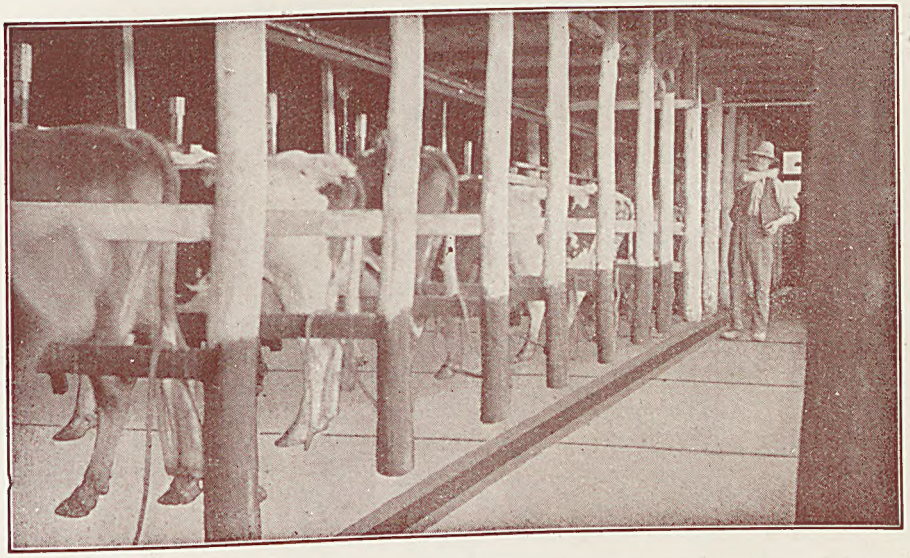

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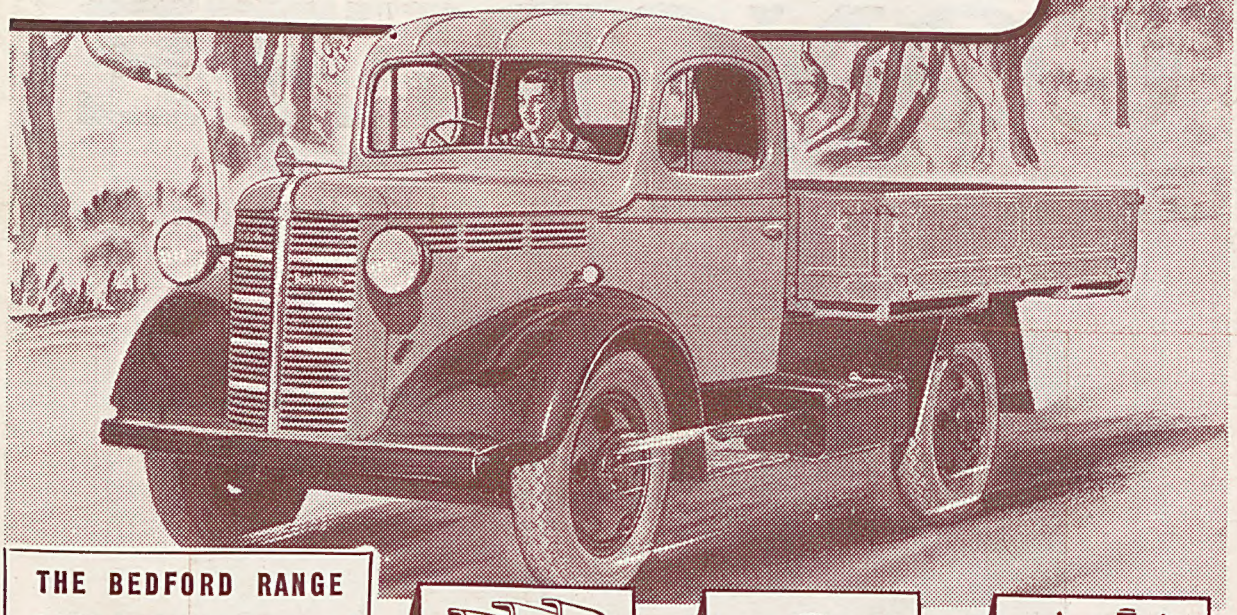

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